UNION OF SOUTH AFRICA

DEPARTMENT OF AGRICULTURE

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Any one wishing to utilize this means of acquiring agricultural literature should obtain a list of the bulletins. This will be sent post free on application to the Department of Agriculture, Union Buildings, Pretoria.

The following are some of the more important bulletins available:—

3d.	Agricultural Experiment: Its Design and Interpretation	Sc. B. 22.
1s. 6d.	Investigations on Export Citrus Fruit from S.A during 1921	1/1922.
1s. 6d	Further Investigations into the Cause and Wastage in Export of Citrus Fruits from S.A.	1/1921.
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1s. 6d.	The Maize Stalk Borer	3/1920.
1s. 3d.	Remedies and Advice. Treatment of Insect Pests	(Chart.)
—	Onion-growing	Repr. 15/1924.
—	Selecting Seed Maize	Repr. 14/1925.
3d	Cotton Culture	Repr. 2/1924.
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3d.	Chicken-rearing	Repr. 22/1924.
—	Non-specific Gall-sickness of Cattle in S.A.	Repr 8/1923
—	Retention of the Foetal Envelope (Afterbirth) in the Cow	Repr. 48/1923.
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—	The Spinose Ear-tick	Repr. 7/1925.
3d.	American Stock in Viticulture	Repr. 17/1925.
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1s.	Fungous and Bacterial Diseases of Plants	L.S. 78.
3d.	Sheep Shearing	29/1924.
3d.	Management of a Sheep Farm	Repr. 47/1924.
3d.	Poultry Yard Month by Month	Repr. 16/1924.
3d.	Breeding for Beef	Repr. 29/1923.
3d.	Fruit Drying	Repr. 17/1923.
3d.	Citrus, Export of	3/1922.
3d.	Raisin-making in South Africa	1/1916.
3d.	Chemical Investigations in regard to Citrus	Sc. B. 40.
3d.	Report on the Cost of Production of Maize Investigations, 1922-23	Sc. B. 38.
3d.	Some further Remarks on Tobacco Cultivation for Nicotine	2/1925.
3d.	Incubation in South Africa	Repr. 32/1925.

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3d.	Incubation in South Africa	Repr. 32/1925.
3d.	Codling-moth in Apricots	Repr. 33/1925.
3d.	Drought-resistant Fodders	Repr. 36/1925.
3d.	The Origin, History, and Characteristics of our Breeds of Pigs in South Africa	Repr. 39/1925.
3d.	Vermin-proof and other Fencing	Repr. 42/1925.
3d.	The Agricultural Problem in South Africa	Repr. 44/1925.
—	Intensive Poultry Keeping for Town-dwellers	Repr. 45/1925.
3d.	Irrigation with Special Reference to the Economic Use of Water	Repr. 47/1925.
—	Sheep Blow-fly Control—A New Method	Repr. 48/1925.
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List of Agricultural Show dates, compiled from details furnished by Agricultural Unions:—

CAPE PROVINCE.

Paarl, 26th and 27th January.
Robertson, 2nd and 3rd February.
Stellenbosch, 3rd and 4th February.
Bredasdorp, 4th and 5th February.
Riversdale, 9th and 10th February.
Caledon, 10th and 11th February.
Malmesbury, 12th and 13th February.
Swellendam, 16th and 17th February.
Worcester, 24th and 25th February.
Rosebank, 2nd to 5th March.
Dordrecht, 2nd and 3rd March.
East London, 2nd to 4th March.
Aliwal North, 3rd to 5th March.
Cradock, 9th and 10th March.
Villiersdorp, 10th March.
George, 10th March.
Kingwilliamstown, 11th and 12th March.
Somerset East, 12th and 13th March.
Ceres, 13th March.
Port Elizabeth, 16th to 19th March.
Queenstown, 17th and 18th March.
Bathurst, 28th and 29th April.
Komgha, 6th and 7th May.
De Aar, 4th and 5th August.
Middelburg, 8th and 9th September.

TRANSVAAL PROVINCE.

Amersfoort, 24th and 25th February.
Carolina, 11th March.

(NOTE. Other show dates not yet notified.)

ORANGE FREE STATE.

Winburg, 10th and 11th February.
Smithfield, 17th and 18th February.
Kroonstad, 23rd and 24th February.
Thaba 'Nchu, 23rd and 24th February.
Rouxville, 24th and 25th February.
Bethlehem, 3rd and 4th March.
Senekal, 10th and 11th March.
Bethulie, 16th and 17th March.
Heilbron, 16th and 17th March.
Vrede, 16th to 18th March.
Boshof, 17th and 18th March.
Bloemfontein, 23rd to 25th March.
Fauresmith, 30th and 31st March.
Philippolis, 6th and 7th April.
Frankfort, 13th and 14th April.
Hoopstad, 5th and 6th May.

NATAL PROVINCE.

Underberg, 14th May.
Vryheid, 8th and 9th June.
Victoria, 17th June.
Klip River, 17th and (18th probably) June.
Royal Agricultural Society, Pietermaritzburg, 23rd to 25th June.
Durban and Coast, from 29th June to 2nd July.
Ixopo, 5th and 6th July.
Richmond, 13th and 14th July.

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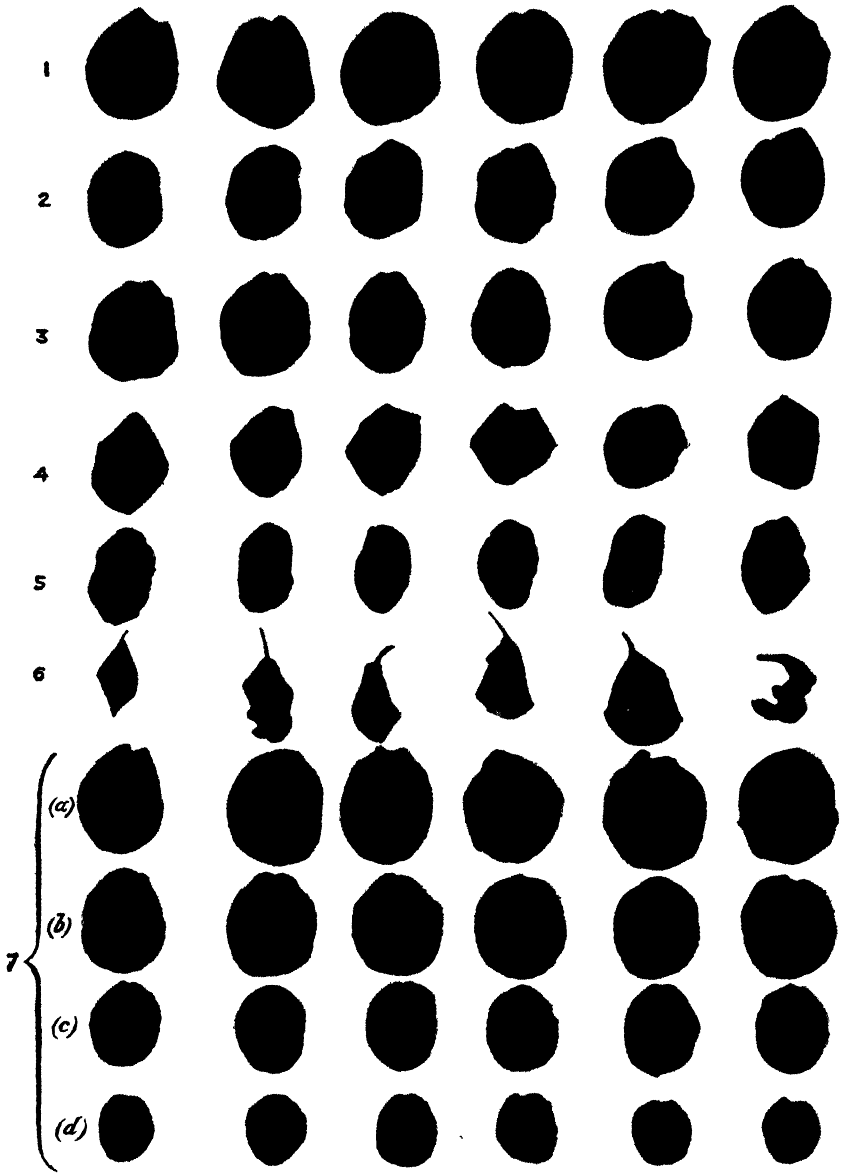

FIG. 1. [*Kathleen A. Lansdell.*

1. Light amber; 2. Dark amber; 3. Very dark; 4. Skins produced from green mouldy berries; 5. Overdipped specimens containing no flesh, caused by fermentation; 6. Trash produced from bunches trailing on the ground. The points of such bunches should be trimmed away when harvesting. 7 The four South African grades: (*a*) 4 Crown, (*b*) 3 Crown, (*c*) 2 Crown, (*d*) 1 Crown.

(See article on Dried Fruits, page 23.)

JOURNAL OF THE DEPARTMENT OF AGRICULTURE.

VOL. XII. JANUARY, 1926. No. 1.

Published monthly in English and Afrikaans by the Department of Agriculture Union of South Africa.

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Applications, with subscriptions, to be sent to the Government Printer, Pretoria.

NOTES.

A Self-reliant Farming Community.

In last month's issue of the *Journal* a comprehensive review was given of the work of the Department on behalf of the farming community. It chronicles the continued advance of the country's great agricultural industry. Perhaps one of the most significant features of our progress is the spirit of self help that is steadily spreading throughout the land and that is evidenced particularly in the steady forward trend of co-operation and the expanding principle of the levy.

At this opportune stage in the history of farming in South Africa, the Minister of Agriculture, General Kemp, has placed before the farmers of the Union a scheme for the consideration of every man and woman whose destiny is coupled with the country's chief industry. The object of the Minister is to help the farmer to help himself and, in leaving behind for all time the old practice of looking to the Government for monetary assistance when seasons are adverse, to develop a sturdy self reliance that will in every respect engender that independence so proudly claimed by the farmer the world over.

General Kemp's scheme is to establish a "Farmers' Mutual Benefit Fund," and its outlines have by now been published far and wide. The full text of the notification sent to the Press in this regard is published below, and the Department takes this opportunity at the opening of a new year bright with the promise of continued progress, of earnestly appealing to every farmer to consider a scheme fraught with so much potential good and wholeheartedly support the efforts of the Minister to further the welfare of the agricultural community.

General Kemp's Scheme.

South Africa, with its variable climate which creates abundance in one year and causes want in the next, has long since felt the need of some system of insurance whereby the farming community may safeguard itself against unforeseen losses that may be sustained in farming. For some reason or other, agricultural insurance does not seem to appeal to the ordinary insurance companies, and at the present the only form of insurance of this nature is on a small scale and confined to insurance of valuable stud stock and on hay stacks against fire in the western Cape Province. The result is that when the agricultural industry is visited by some disaster out of the ordinary, such as drought, floods, or locusts, the farmers can look forward to no compensation for their losses, and they must then turn for relief to the Government, which is bound to assist them in order that they should not swell the ranks of the poor whites.

It is this necessity for insurance against unforeseen contingencies that the Minister of Agriculture wishes to provide for by establishing a fund to which every bona fide farmer will be required to contribute as a provision against the lean years in agriculture. It will thus be a fund established by the farmer for the use of the farmer, and will teach the farmer to help himself and at the same time to lend a hand to those of his fellow farmers who stand in need of help. It is the principle of co-operation, the principle which by united action brings communal advantages. The object of the Minister is to help the farmer to help himself, and instead of having a spoon-fed farming community, to develop a sturdy self reliant set of farmers.

Such a fund might take the form of a simple insurance fund to which the individual farmer would have to contribute in proportion to the value of his production; in other words, State insurance. This possibility is, however, not to be recommended at present; the State would saddle itself with a colossal liability, and it is quite impossible for the farmers to pay premiums to cover all exceptional losses, losses which in the case of live stock alone sometimes run up to £10,000,000 in years of drought. South Africa is not yet ripe for State insurance.

The Minister of Agriculture now proposes to initiate a "Farmers' Mutual Benefit Fund," which is to be used to make relief loans to farmers who have fallen into distress through some exceptional occurrence. This fund, although it must in the beginning of necessity be small, will gradually grow and in the course of years will be a sound security against the uncertainties of farming. The farmer will be assured of obtaining a loan on the most favourable terms and at a purely nominal rate of interest, so that he will be able to re-establish himself without having to appeal to the Government for aid, as is so often done to-day.

Every bona fide farmer, whether bywoner, tenant, or owner, will have to contribute in proportion to his income. Inquiries have been made in regard to the possibility of collecting the contributions in an indirect way, but this does not seem feasible when it is taken into consideration that the collection will have to be made in the most economical manner and that the costs of administration will have to be kept as low as possible. Existing channels will have to be made use of and an expensive collecting organization avoided. If the contributions are connected with income, the problem of

collection is solved, and it can be undertaken by the Commissioner of Inland Revenue. A direct levy is thus recommended.

The following is the basis upon which it is proposed the levy be made:—

(*a*) Each bona fide farmer who does not receive an income tax form, is to pay an annual sum of ten shillings (10s.). It is estimated that the farmer in this group has an income of less than £100 per annum.

(*b*) Each bona fide farmer who receives an income tax form, but who does not pay income tax, is to pay an annual sum of £1 (one pound). It is estimated that the farmer in this group has an income of between £100 and £300. Contributions might be made on an ascending scale, but owing to practical difficulties, this is not possible.

(*c*) Each bona fide farmer who pays income tax is to pay a minimum of £1 per year plus 5 per cent. on the amount of his income tax.

(*d*) Bywoners will pay an annual sum of 5s. each.

It is considered that in this way it will be possible to obtain a sum of roughly £75,000 per annum.

The amount collected is to form the capital of the fund and is to be deposited to the credit of the fund in the Land Bank, by whom the fund is to be administered. The capital of the fund is to be lent to the farmers by the Land Bank at its usual rate of interest as a loan from the Bank, and the capital is not to be touched for relief loan purposes until it reaches a sum of £2,000,000 and then only in exceptional circumstances. The object is to let the capital increase until it reaches £10,000,000 or more. Ordinarily, the interest on the capital is to be used for relief loans. After the first year, there will be something like £3,000 available. The amount of interest will increase every year and will be augmented by the interest on relief loans which will come in gradually.

Emergency loans are to be made to farmers who have suffered exceptional losses through drought, locusts, stock diseases in the form of a plague, hail, floods, and other causes which the governing body may regard as of an exceptional nature. These relief loans are to be made for a maximum period of seven years on a graduated scale of interest:—No interest charge for the first year; 1 per cent for the second year; 2 per cent. for the third year; 3 per cent. for the fourth year; and 4 per cent. for the fifth and remaining years. Repayment of the relief loan is to be made in instalments starting two years after the date of the loan or as the governing body may determine. The maximum loan to any one farmer is not to exceed £300. The borrower will be expected to give a certain measure of security. The goods bought with the borrowed money may also serve as security.

The farmer thus benefits from his contributions in two ways, namely, by borrowing from the capital fund under Land Bank conditions and borrowing on the interest of the fund for relief loans at a nominal rate of interest. The poor farmer as well as the rich farmer will contribute to the fund, and both classes may use the fund. Both are equally subject to adversity in their farming, and there will be no question of the rich farmer having to pay for his poorer fellow-farmer.

General Kemp has repeatedly given his assurance that he will not introduce legislation until the farming community has signified its approval of the scheme. The Minister, therefore, now submits his proposals to the farming community in the hope that they will be fully discussed and considered. He wants the support of the farmers when the necessary legislation is introduced into Parliament, so that he can then speak in the name of the farmers of the Union.

General Kemp feels very strongly the need for such a fund and wants the farmers to understand that it will be *their* fund. It is a fund more for the future than for the present, and even if the farmer of to-day does not obtain full benefit from it, his children and grandchildren will enjoy the benefits of it, and will be grateful to their ancestors for their wisdom. What a strong guarantee against adversity in our agricultural industry will not such a fund of £10,000,000 be?

Farmers of the Union! The Minister of Agriculture wants to help you to help yourselves! Are you going to support his efforts and approve of his scheme? The Minister awaits your answer through the Press, through your organizations, and from yourselves.

South African Plants as Remedies and Poisons.

Professor J. M. Watt, Professor of Pharmacology at the University of the Witwatersrand, and his staff are undertaking an investigation into the use of plants, etc., as medicines, charms, and poisons among the inhabitants of Southern Africa. The use of plants for this purpose by the aborigines of any country has always been a subject of interest, and many well-known medicines derived from plants have through this source been brought into medical practice.

In South Africa there is a wealth of plants used by the natives as medicines, and many of these are mentioned in the writings of the early Cape travellers. In 1868 Dr. Pappe, the first Government botanist of the Cape Colony, published a small materia medica, and listed 115 species used by the natives and old colonists. Andrew Smith in 1888 published a South African materia medica and noted 137 species of plants. The Rev. A. Bryant in 1909 published a paper on Zulu medicines and medicine men, and in 1917 Dr. E. P. Phillips, in his account of the Basutoland flora, mentions many plants used medicinally by the natives. Most of the chemical work on native plants has been done by Dr. R. Marloth and Dr. C. F. Juritz, and published in various journals. The Division of Veterinary Education and Research has done a large amount of work in the investigation of poisonous plants, and the Division of Botany has had many reputed medicinal plants investigated.

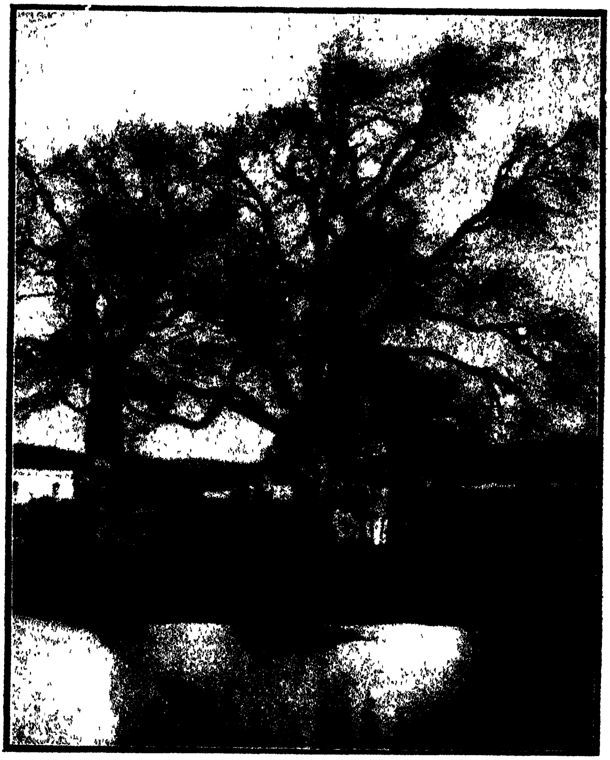
The subject of native medicinal plants has up to the present received a fair amount of attention, but no organized investigational work (except in the case of poisonous plants) has been attempted, so that we welcome the scheme initiated by Professor Watt. He has issued a questionnaire which it is hoped will induce many who have knowledge of the uses of plants as drugs, etc., to collect material and forward it to Professor Watt with all available information.

The National Herbarium in the Division of Botany, Pretoria, as the central herbarium for the botanical survey of South Africa, has offered assistance in identifying specimens and in keeping specimens in the collection as permanent records.

The Export of Fruit.

The regulations governing the export of fruit this season were published in Government Notice No. 1922 of 28th October, 1925. They follow closely the lines of the previous season's regulations, excepting that the Fruit Export Control Board takes the place of the Government Fruit Inspector in so far as advices of intention to ship fruit and registration of marks, etc., are concerned. This year, also, every exporter will be allotted a distinctive number, which is to be placed on each box of fruit he exports.

There are a few alterations in the dimensions of certain grades, and it is specially provided that all boxes of fruit must be packed to their full capacity. Fruit rejected and not removed within seven days may be removed by the fruit inspector at the cost of the consignor.



Pear Tree.

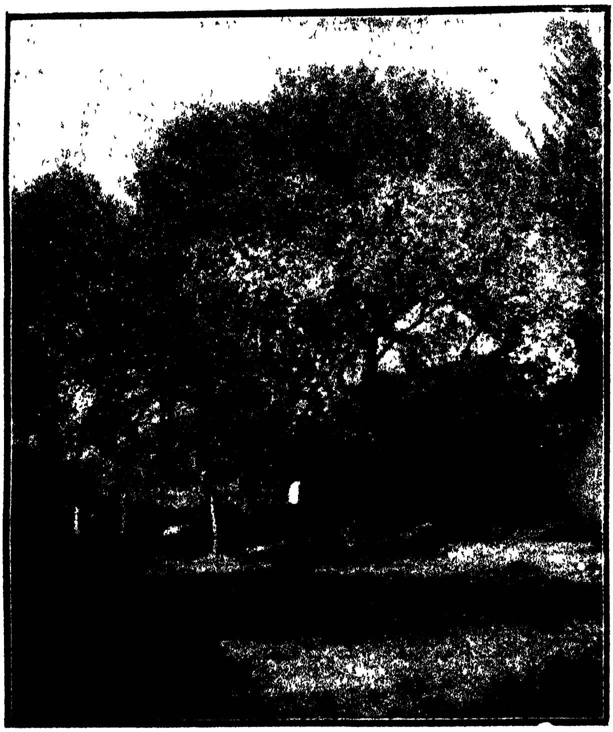
All reference to pineapples disappears from these regulations, which are concerned particularly with deciduous fruits. Provision is made for pineapples in the regulations governing the export of citrus fruit.

Big Fruit Trees.

From many parts of the world records of big fruit trees are heard of, but if some of our larger fruit trees were measured up, it would probably be found that as far as dimensions and bearing

qualities are concerned, they would be very hard to beat. This applies especially to walnut, orange, almond, pear, and fig trees. In a recent tour through the Oudtshoorn, Calitzdorp, and Ladismith areas, the Chief, Division of Horticulture, came across some very fine specimens of each of such trees, as shown in the accompanying photographs of the pear and almond trees occasionally encountered there.

The giant trees are naturally fairly ancient. Probably a century or more has elapsed since the seed was placed in the ground by some of the progressive voortrekkers settling in those parts.



Almond Tree.

It must not be assumed that these trees were planted individually and indiscriminately here and there on the farm. They are actually the survivors of what in those days constituted the orchard, laid out round the homestead for the purpose of providing the household with fruit throughout a large part of the year. And in most instances many different kinds of fruits were grown—apples, pears, peaches, plums, apricots, quinces, pomegranates, guavas, grapes, mulberries, figs, walnuts, almonds, etc. The early settlers rarely made a mistake in selecting a site or the type of soil on which these trees could best be grown. Through the ravages of time and neglect to combat insect pests and diseases, many of these well laid out orchards have now

lost their original form, and only a few trees are left as silent witnesses to the wonderful fertility and possibilities of the soil, if properly handled, for fruit growing.

In the illustrations the large pear tree produced a crop of 2,000 lb. of fruit last season (1925). Its height is 50 feet, and the circumference of the trunk about 12 feet. The almond tree in full bloom has a circumference at the trunk of 9 feet, and is about 30 feet high, and has produced as much as two muid sacks of almonds in one season. The third illustration is of a four-year-old olive tree showing extraordinary growth. It bore fruit the third season after planting.

Four-year-old Olive Tree which bore fruit in its third season.

Agricultural Education: Reorganization.

The administration of the Schools of Agriculture which recently fell under the direction of the Director of Field and Animal Husbandry, has been placed under the control of the Chief of the Division of Extension as from the 1st November, 1925. The name of the new Division has been changed to "Education and Extension." Lieutenant-Colonel H. S. du Toit has been promoted to the post of Chief of this Division, and Mr. W. J. Lamont, until recently the Principal of the Elsenburg School of Agriculture, has been transferred to Pretoria as Assistant Chief thereof.

Sugar-beet Industry.

The question of establishing a sugar-beet industry in South Africa was discussed in the April, 1925, issue of the *Journal*, when the economic and other factors affecting the position were briefly set out. The cultural experiments then referred to are being continued and extended, and while the further data that will be obtained therefrom will undoubtedly throw more light on the possibilities of successfully producing the sugar-beet in various localities of the country, it is safe to say now that the crop is highly suitable for the wide high veld area of the Transvaal (and other areas are likely to be similarly suitable). It may, therefore, be stated that there is every likelihood that the sugar-beet can be grown in sufficient quantities in South Africa to supply the requirements of any factory that may be established for beet-sugar production. But here lies the main difficulty.

An ordinary "diffusion" type of factory would cost about £300,000 and require nearly £100,000 to meet working expenses. It would need a supply of about 100,000 tons of topped beets per annum if it is to be worked economically, and this would require an area of 10,000 acres under crop, which, moreover, would have to be within a certain radius of the factory and be intensively cultivated. It is not clear whether such a proposition would appeal to farmers under the present South African conditions of comparatively cheap land and sparse population. On the surface, indeed, it would seem that the farmer on the high veld, for instance, would find it more profitable to cultivate a large acreage of mealies, than the smaller one of beets that would require the same attention and working costs. Yet there are advantages that may, perhaps, ultimately far outweigh this seemingly uneconomic proposition. Sugar-beet growing forms part of an intensive system of farming. To secure good yields of healthy crops of beet it is necessary to use a rotation of crops and to fertilize the land regularly. Such a system of agriculture immediately makes possible the development of a live stock industry and affords employment for a large amount of labour, leading, according to experience in other countries, to increased fertility of the soil, stabilization of agricultural conditions, and the absorption of labour at an estimated rate of one man for every 10 acres of beet.

It is evident, therefore, that a "diffusion" factory would have to be the centre of a very extensive scheme of closer settlement. It is a matter in itself that requires careful consideration. On the one hand, there is involved a large amount of capital expenditure; on the other hand, there are the valuable experience in closer settlement the country would derive from the scheme, the employment it would afford, and the development in the live stock industry that would follow, regard in this respect being given to the valuable feeding properties of the beet tops in the building up of the dairying industry.

There has recently come into prominence a new process of manufacturing sugar-beet that may profoundly influence the position in South Africa. This is the De Vecchis process, by which beets are dried at small drying stations and then shipped to the central factory. This allows the beets to be grown over a much wider area and enables the factory to work for a much longer period than the one that treats the fresh article. Thus working costs are reduced, management is simplified, intensive cultivation under closer settlement is not essential,

and generally the scheme would be most suitable to conditions in this country. The De Vecchis process, however, has still to be proved, and it is receiving the close attention of countries oversea. In England a small experimental factory is likely to be established for the purpose of testing the system in a practical way. The Department is keeping in touch with developments in this direction, recognizing that if the process is a technical success it would be an excellent one for South Africa; indeed, at present it appears to offer the only prospect for the successful establishment of a factory in this country.

In the meantime the Department is proceeding with its experiments in beet-growing over fairly large areas, keeping careful records for comparing the relative profitableness of the labour and capital invested in growing beet with the returns that would have been obtained from growing other crops.

Whatever may be the outcome of the De Vecchis process and of the Department's experiments, there will yet remain for consideration the wide economic question of sugar production generally. South Africa already produces cane-sugar in excess of local consumption. A market outside her territories will, therefore, have to be found in competition with other sugar-producing countries, and although a large potential market lies at our doors in the native population, cost of production and other factors that complicate the sugar industry to-day will need to be satisfactorily disposed of in deciding upon the part South Africa is to take in the world production of sugar.

The time has not yet arrived, therefore, for making a definite pronouncement. The results of the Department's investigations will be made known in due course.

Transmission of Seeds by Agricultural Parcel Post.

The Postmaster-General draws attention to the practice of posting parcels of imported seed at the agricultural rate. A large proportion of the seeds sold in the Union is imported, but it is observed that the majority of parcels of seed are forwarded by agricultural parcel post, which is not applicable to seeds produced outside the Union. It is pointed out that the making of a false declaration in respect of the agricultural rate renders the sender liable to a heavy penalty, and that to declare seeds as being produce of the Union, without being personally aware that such is correct, is a risky procedure.

The Storage of Eggs.

While our export trade in eggs is growing and is undoubtedly a great factor in the successful progress of the poultry industry, it is significant that South Africa, due to lack of co-operation among producers, has still to import foreign supplies of eggs to meet local needs during our off season, and the question naturally arises as to why sufficient of our own eggs are not stored to meet the period of scarcity. If it is economically sound to send our eggs on their long journey of six thousand miles, would not the prices realized equally cover the risk of deterioration and cost of refrigeration for many months in a properly managed local cold store? There are, however,

many problems that have still to be solved in connexion with the storage characteristics of eggs, notwithstanding the world-wide use of the egg and the thought that has been bestowed on the handling and transport of the article. It is the complexity of behaviour of the egg itself that has to be contended with.

Much, indeed, has been written on the subject of the storage characteristics of eggs, and a bulletin * has now been published by the Department which will prove valuable to all concerned in the poultry industry, the object of the writers being to sift out the vast literature and fill in the gaps to some extent. The bulletin, which has coloured and other illustrations, gives a clear description of the structure of the egg, storage processes, etc. The writers point out that cleanliness at every stage of its production, packing, and marketing, plays a very important part in the immunity of the egg from infection and break down; also, that visual examination should very soon enable the farmer to eliminate eggs of high evaporation and mechanically weak shell.

Briefly, the bulletin furnishes the following advice:—

The storage temperature for eggs should be maintained as accurately as possible at 32° F.

Inferior shelled eggs should be rejected as being liable to lose too much water by evaporation. Brown eggs are in general superior to white from the point of view of evaporation losses.

All eggs for storage or export should be non-fertile, and strict precautions as to cleanliness should be observed to avoid risk of infection.

Humidity of storage and ship's chambers should never exceed 80 per cent. Forced air circulation is essential for long-period storage. The humidity should be considerably lower if there is no forced air circulation.

Egg packs should permit free air movement around every egg.

Storage rooms should be cleaned after having been used for meat or other products before being used for eggs, and such rooms should be free from all smell.

Export of Eggs to Norway.

The Department of Agriculture is advised by the Consul-General for Norway that all foreign eggs imported to Norway must be marked in letters of at least 4 centimetres in height with the name of the country of origin.

In the case of eggs which are preserved or have been kept in cold storage, the cases must be clearly marked respectively "Pickled Eggs" or "Cold-stored Eggs."

* "Note on the Storage of Eggs," by E. A. Griffiths, Physicist, D. J. R. de Villiers, Assistant, and Leitch Anderson, Egg Inspector. Science Bulletin No. 41, Price 3d. prepaid. Obtainable on application to the Editor, *Journal of the Department of Agriculture*, Pretoria.

DEPARTMENTAL ACTIVITIES.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview month by month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him.—EDITOR.)

THE DIVISIONS.

BOTANY.

Wart Disease in Potatoes.—An outbreak of wart disease in potatoes(*Synchitrium endobioticum*, Perc.) has occurred in some small allotments in the neighbourhood of Johannesburg. Since the first diseased tuber was submitted for examination on 18th November, infection in the Up-to-Date potato has been found in three market gardens adjoining one another at Hamburg, and one at Witpoortje. These premises have been placed in quarantine to prevent further spread of the disease and a detailed inspection is being carried out of the market gardens in Florida, Roodepoort, Witpoortje, Klipriver, and a portion of the Krugersdorp and Germiston area.

The disease was noticed last year by the occupier of one of the Hamburg allotments, but was not reported: consequently wart disease had this season increased to an alarming extent. It is stated that the seed from which the first wart-infected crop was grown was purchased on the open market.

This outbreak in market gardens in a populous district is of a far more serious nature than the outbreak in Natal in 1922. In the latter case, wart disease was found to occur only on two stock farms where potatoes were grown only for home consumption and not for the market. No further cases were found at that time after a thorough and extended inspection. The quarantine measures imposed in that case involved no hardship to the owners, and since only two small sites were infected these could thoroughly be disinfected.

The present outbreak concerns gardens where potatoes are grown for the market and is in a populous area, so that there is considerable danger that the disease has been spread in soil clinging to the boots of persons walking from one place to another.

Growers are asked to assist in preventing the spread of this most destructive disease by reporting cases of suspected infection to the Division of Botany, Box 994, Pretoria. Specimens may be sent through the post, free of charge.

Streak Disease of Sugar-cane in Mauritius.—Specimens of sugar-cane and maize leaves, from Mauritius, submitted to the Government Mycologist, Durban, have shown that streak disease may affect these plants in that island. Observations upon the occurrence of the disease

have recently been published by Mr. E. F. S. Shepherd, in "La Reveue Agricole de L'Isle Mauria." Mr. Shepherd is also of the opinion that streak affects certain of the sugar-cane in the island of Reunion. These are the first records of streak disease from a locality outside South Africa.

ECONOMICS, MARKETS, AND CO-OPERATION.

Home Economics.—The lecturer in Home Economics, Elsenburg, recently started at French Hoek, Paarl, Wellington, and Somerset West Strand societies called "Home Industries." The object of this movement is to promote interest among women in various home activities. Support of the scheme has been encouraging. In Paarl, for example, the membership is 63. It is proposed to have meetings of each Home Industry centre once monthly to discuss various matters in connexion with the home. It has also been arranged for lecturers to address the members once monthly on such subjects as cookery, upholstery, dressmaking, millinery, flowermaking, bulb culture, etc. On account of the support the movement has been given by the ladies of the above centres, it is intended to institute further societies at other centres.

ENTOMOLOGY.

Chloridea obsoleta.—The following remarks upon this insect occur in the October, 1925, report of Dr. Pettey, Elsenburg School of Agriculture:—

Chloridea obsoleta is very abundant in the Cape, and has done enormous damage to the fruit-crop, especially stone fruits. It is much more numerous where legumes have been planted in orchards and where weeds have been allowed to grow during the winter in orchards. Numerous eggs have been found laid on peach fruits and on peas in Drakenstein and Ceres. Two years ago larvae from eggs found on peaches at Orchard Siding were reared to adult moths. A 4 per cent. solution of Clensel and Katakilla at double the concentration, recommended to control caterpillars, failed to kill a single larva.

Tree Crickets.—In his report for October, 1925, Dr. Pettey states, concerning certain tree crickets which had been found destructive to peaches, that they were found to have hatched in October from eggs laid last summer in wild blackberry (*Rubus rigidus*), *Salvia paniculate*, *Salvia africana*, and in the very common veldbush near the Orchard, *Anthospermum aethiopicum*. The three first grow along a sluit bordering the orchard.

Eggs were found most numerous in the last plant. This suggests that veld-burning near the orchard will help greatly to prevent the pest from attacking the fruit.

Peach twigs in which eggs had been deposited were cut off in April. All eggs failed to hatch. This suggests that early winter prunings may effectively dispose of the infestation in the orchard itself without the necessity of burning the cut-off twigs.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

POTCHEFSTROOM, TRANSVAAL.

Fertilization.—" Cultivation is manure." This saying is particularly true in the summer months when moisture and heat are favourable for nitrification and a well cultivated soil will produce plenty of soluble nitrates for feeding the crop, and producing a vigorous growth.

Potato Fertilizers.—For January planting, the soil should, if possible, be well dressed with kraal manure at the rate of 8 to 16 tons per acre. This should be ploughed or disced in and then the weeds which spring from that dressing of manure got rid of before the furrows are drawn for potatoes. If the manure is limited in quantity, it can actually be spread about one inch deep in the furrows, and on top of it superphosphate at the rate of 600-800 lb. per acre. If no manure is available or no green manure crop has been ploughed in, apply 1,000 lb. per acre of superphosphate, 300 lb. of ammonium sulphate, and, if the soil is an old one, 150 lb. sulphate of potash. These fertilizers can be mixed before application and the mixture applied in the rows. Care should be taken to plant the tubers at the side of the rows and a couple of inches away from the fertilizer. Direct contact of tuber and fertilizer is often the cause of a poor stand.

Lucerne Fertilizers.—Land which is being summer fallowed for lucerne planting in the autumn should be dressed with 500-600 lb. per acre of a mixture of two parts superphosphate and one part rock phosphate, and the fertilizer ploughed under as deeply as possible to stimulate the downward growth of the lucerne rootlets and establish a healthy root system. Land so treated should not again need fertilizing before August, 1927, when it should be dressed with 400 to 500 lb. per acre of superphosphate before the new growth begins.

GLEN, ORANGE FREE STATE.

Attention to Poultry Plant.—It is now the time to have a spring cleaning of all poultry houses. All birds should be examined and treated for insects. The birds intended for the coming breeding season should get special treatment. Assist them through the moult by supplying a little sulphur in the mash; sunflower seed in their grain will also help considerably. Breeders not properly through their moult at the commencement of the breeding season will not produce fertile eggs, and early chicks are desirable. During the hot months it is advisable to supply all the birds with a little epsom salts at least once weekly, which will keep their blood cool and in proper condition; also examine the droppings under the perches for worms, and if present treat accordingly. (Tobacco powder in their mash 3 to 5 per cent.). Supply as much green food as possible.

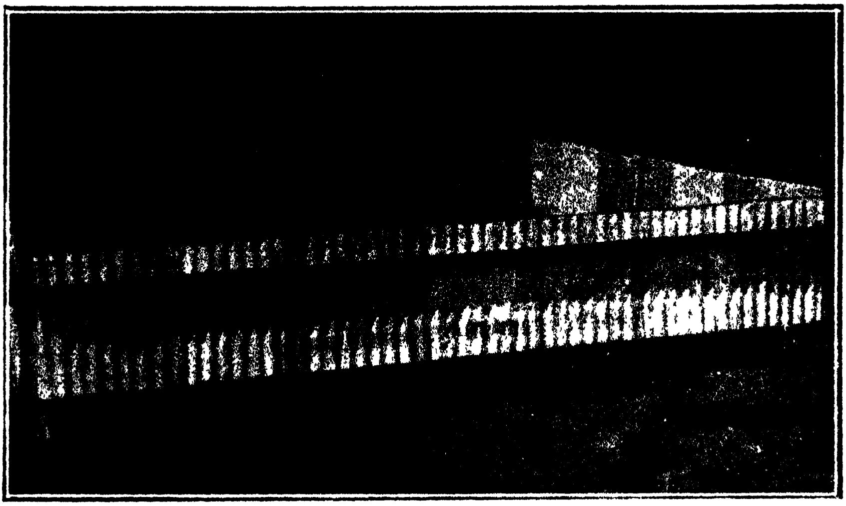
It is advisable to dig in in each run a light dressing of lime, and then to sow a crop of some kind, such as oats, rye, etc. The growth of such a crop will freshen the ground considerably, and also provide shade and green food for the birds when they are returned to the runs in April or May.

Give the young stock as much freedom as possible, and do not overcrowd at night. Try to keep the pullets from laying for a further period of two months; this can be done by continually shifting their quarters. Preventing them from laying too early will be repaid by better matured stock, and when once they start laying the eggs will be larger and sell better. Allow all young turkeys and goslings over six weeks of age as much freedom as possible, preferably on lucerne lands, or herd them daily in the veld, where they will find an abundance of insect-life and natural food which is essential to their well-being; consequently they will grow more rapidly.

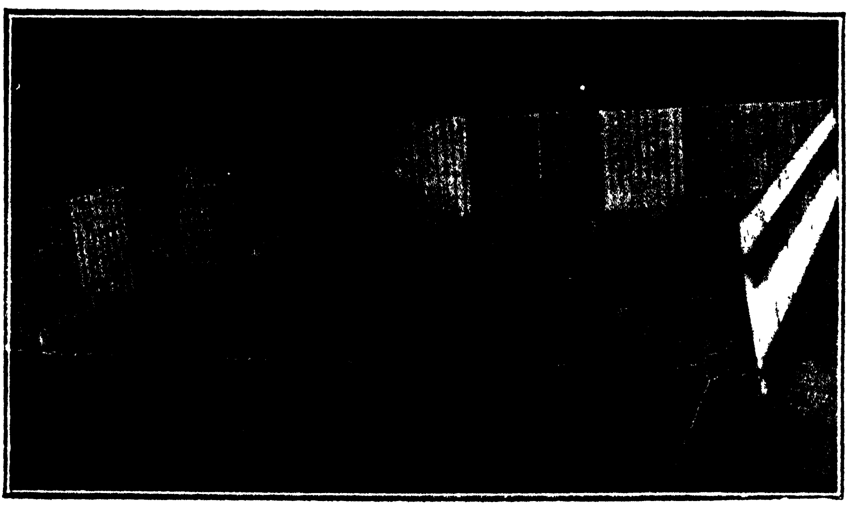
Interest of Farmers in Experiments.—Frequently at Agricultural Union Congresses farmers request the Government to establish more co-operative experiments, demonstration farms, or other means of providing for experiments locally in one form or another, so that farmers may be provided on the spot with information in an ocular or other easily assimilable form. The experience in this respect, however, of those connected with such experiments and existing experimental farms, is disappointing, and does not support the view that any immediate and rapid spread of information, or adoption of better methods, would come about as a result of the wholesale establishment of such farms. Those farmers who do have co-operative experiments on their farms are disappointed at the lack of interest shown therein by their neighbours. On one such farm in the eastern O.F.S., for instance, during the 1924-1925 season, only three farmers visited a co-operative experiment with maize and potatoes, although it was conducted under the aegis of the local farmers' association. This cannot be said to encourage a wider application of the system.

Tour of Farmers in the O.F.S.—The benefits to be derived by farmers touring in organized parties through other farming territories, whether in their own country or outside it, is undoubted, and the question of organizing tours of O.F.S. farmers in other parts of their own Province has been engaging the attention of the Agricultural Union for some considerable time. The proposal met with unanimous support at the last Annual Congress, and a sub-committee has now been appointed to work out a scheme. Briefly, the scheme is that a group, say, of maize farmers should visit the sheep areas, and, vice versa, a group of sheep farmers should visit the maize areas and so on, the object being to acquaint the one farmer with the methods employed by, and the advantages and difficulties of, the other farmer, thus bringing farmers into contact with each other and encouraging direct dealing and all the other benefits that follow the confidence engendered through knowledge. It is proposed to limit each party to about fifty, that the members be accompanied by Government officers, who will be available for technical advice, and that on arrival at any centre the party should be met and escorted to one or other farm in the neighbourhood, the next day proceeding to a different centre. Farmers' and agricultural associations having any

suggestions to offer on the subject or desirous of offering any facilities for such a visit to their respective districts, are requested to communicate with the Secretary of the O.F.S. Agricultural Union, Box 377, Bloemfontein, or to the Principal, School of Agriculture, Glen.



Portable Pig Pen - external view.



Portable Pig Pen Side let down to show internal view.
Shade is obtained by putting a rack covered with sacking or maize stalks, etc., across a corner of the pen.

A Portable Pig Pen.—The open air system of pig keeping has many advantages, but the cost of fencing all field crops that may be grown for grazing is very considerable and is often a deterrent to the adoption of the system. The construction of a portable pig pen

for grazing pigs on such crops as oats, cowpeas, etc., can, however, easily be undertaken by any farmer. Proceed as follows:—Procure two lengths of 3 inches by 2 inches baltic deal 14 feet long, and nail or screw thereto 3-foot lengths of corrugated iron, so that the measurement between these timbers is 19 inches. Make four similar sides. On both ends of each piece of timber bolt a piece of 1 inch by ¼ inch flat iron having an eye formed on the one end, which eye projects about 2 inches from the end of the timber. Now attach these pieces of iron to the timber in such a fashion that when the sides of the pen are brought together with the wood to the outside of the pen, the eyes on one side of the pen are exactly underneath the eyes on the adjoining sides. Four pins, 4 feet in over-all length, are now manufactured from ½ inch or ⅝ inch round iron, one end of each pin being bent to form a handle and the other end pointed. The pins are passed through the eyes and connect the sides of the pen together. If considered necessary the sharp ends of the pins can be forced into the ground to make the erection more secure.

This type of pen is very suitable for the purpose, since by the withdrawal of the four pins the sides are quickly and easily separated and the pen can be conveniently transported on a waggon to any desired site. To provide shelter for the pigs one or two sheets of corrugated iron can be laid across the corner of the pen. The pen can conveniently be moved by two natives. The pen used at Glen was 14 feet square, which size was found suitable to fit between the ridges forming the "akkers" on the irrigated lands. It has proved very valuable for grazing, by pigs, of crops such as oats, cowpeas, etc., the procedure being to put up to five large pigs (or more of small ones) in it, and shift every day or as often as necessary to an ungrazed patch of land.

The equipment outlined above has not yet proved entirely satisfactory owing to the difficulty of shifting each day. Detachable wheels have been tried, but have not solved the difficulty. It has been suggested that the addition of three more sides—making a total of seven in all—would meet all the requirements. A further note on this improvement will be issued when a proper trial has been made.

Leguminous Crops for Green-manuring.—In those areas in which the first frosts are not likely to occur earlier than the second or third week of April, it is not too late now to put in a legume crop. There are two important reasons why a leguminous crop should be planted. Firstly, the majority of our soils are deficient in humus, a deficiency undoubtedly responsible for many of our so-called worn out soils. Owing to the very limited supply of kraal manure on farms, it is necessary to resort to the use of a green manure to remedy this deficiency. For this purpose a legume crop is most desirable. Secondly, protein is generally lacking in the rations of our farm animals owing to our cropping system. To realize the most economical returns, it is undoubtedly necessary to include more protein concentrates or at least more protein hay in the ration.

The best adapted legumes over the major portion of our (cropping) area are the cow-pea, soy-bean, and the mung-bean. The cow-pea is the best known, and any harvesting difficulty can be overcome by planting it with Sudan grass or Inyati (Pearl Millet), which not only facilitates harvesting, but also curing.

For green-manuring, the crop should be ploughed under, generally when the pods have formed but not matured, although it may be done earlier. Early varieties of soy-beans such as Early Brown and Ito San have been grown with success for seed production.

CEDARA, NATAL.

The New Cut-worm Bait.—Cut-worms have been unusually destructive this year, some growers in Natal having replanted maize four times. The attack is attributed chiefly to the heavy rains last March tending to favour winter-weed growth and enabling large numbers of worms to survive the winter, when the cut-worm mortality, due to starvation, is generally very high.

The new cut-worm bait described in the *Journal* of November, 1924, was not recommended for use in maize, pending further study on cost of baiting. By extensive use of this bait on Cedara maize-lands, exact figures can now be given on cost.

Broadcasted at rate of 200 lb. per acre (seven paraffin tins not quite full): cost 5s. 6d. per acre.

Baiting each plant after plants are up with spacing $3\frac{1}{2}$ by 1 ft. (12,500 plants per acre): cost about 3s. per acre.

These figures do not include labour costs. Two natives working together can broadcast ten acres per day. One native can chop up 200 lb. of prickly-pear in one hour. Sodium fluoride can be bought in large quantity for 1s. 3d. to 1s. 6d. per lb.

Butterflies (*Pyrameis cardui*, whose caterpillars have been so destructive during the past season, and *Pieris* spp.) are attracted to the scattered bait, feeding on it greedily. Although not yet scientifically tested against these butterflies, there is little doubt that they are poisoned by the bait.

Winter Root Crops for the Stock Farm.—In the stock areas of Natal the provision of succulent feed during the winter months is a matter that should receive very careful consideration. January and February are good months for planting winter roots and other succulent crops.

The mangel, owing to its sweetness, is esteemed by all classes of live stock. For best results, the seed should be planted early—not later than January. The mangel cannot be grown with success in every part of Natal; thus, before it is introduced into a cropping system, make certain that the soil is moist and rich and that the seed is of high germination capacity.

The turnip and swede are very closely related to each other, and both are sometimes grown on the same farm for the reason that the turnip can be fed earlier than the swede; the latter has also better keeping qualities than the turnip. It will be found that the swede thrives best on new lands.

Rape is another winter crop worthy of close attention. There are few crops capable of providing such an abundance of green food in such a very short space of time as rape. Thus it presents itself as proving suitable for late planting or as a succulent food for early feeding.

Chou moellier is one of the hardiest winter crops that can be produced in areas with a good rainfall. At Cedara and other centres it has withstood frosts and drought well. It is a crop of excellent keeping qualities, and instances are known of chou moellier being fed to stock up to November.

The field carrot may be selected for growing on soils that are too sandy for other roots.

Rate of Seeding per Acre.

Mangel	6 to 8 lb. in rows $2\frac{1}{2}$ to 3 feet apart.
Turnip	3 to 4 lb. in rows $2\frac{1}{2}$ to 3 feet apart.
Swede-turnip ...	3 to 4 lb. in rows $2\frac{1}{2}$ to 3 feet apart.
Chou moellier..	3 to 4 lb. in rows 3 feet apart or transplanted; 3 feet by 1 foot, i.e. 14,520 plants per acre.
Rape	3 to 4 lb. in rows $2\frac{1}{2}$ to 3 feet apart; 6 to 8 lb. broadcast.
Field carrots ...	2 to 3 lb. in rows 2 to 3 feet apart.

Plants of the above, with the exception of chou moellier, are thinned out to 6 to 9 inches apart in the rows.

CITRUS CANKER ERADICATION.

INSPECTION WORK, NOVEMBER, 1925

Farms Inspected—

Rustenburg District (Hex River Ward).—Buffelspoort No. 668, Badfontein No. 647, Boschfontein No. 381, Buffelshoek No. 900, Elandskraal No. 321, Elandsdrift No. 248, Zuurplaat No. 822, Groenkloof No. 418, Roodekopjes No. 171, Rustenburg, Waterval No. 544, Kaffirskraal No. 915.

Pretoria District (Crocodile River Ward).—De Kroon No. 420, Schietfontein, Vissershoek No. 45, Wildebeesthoek No. 611, Krokodildrift No. 327, Roodekopjes No. 132.

Waterberg District (Nylstroom Ward).—Buffelspoort No. 1770, Grootnylsoog No. 1611, Kleinsnylsoog No. 2146, Nooitgedacht No. 1104, Donkerpoort No. 1804, Vaalkop No. 655, Nylsoog No. 1611, Zuurvlei No. 8, Gemsbokspoort No. 1055, Zuurvlei No. 1055, Karreefontein No. 1805, Driefontein No. 6, Elandspoort No. 1561, Rhenosterfontein No. 1789, Doorndraai No. 1011, Roodepoort No. 2148, Warmbaths, Roodekuil No. 1728, Buiskop No. 1532, Tweefontein No. 1554, Boschpoort No. 2151.

Fresh Outbreaks.—Nil.

Total Number of Nursery Trees Inspected.—12,194.

Total Number of Trees Inspected.—28,935.

Total Number of Trees found Infected.—Nil.

Number of Inspectors Engaged.—14.

THE WASTAGE IN EXPORT GRAPES.

Results of Last Season's Experiments.

MR. VAN NIEKERK, the Government Viticulturist, reports that, as instructed by the Minister of Agriculture, investigations were undertaken last season in regard to the degree of wastage in export grapes that is due to faulty cultural, harvesting, packing, and transport methods.

The grower usually attributes wastage to lack of cold storage control, or to protracted period of storage before the fruit is shipped. Yet, it is felt that the producer can materially assist in reducing wastage by improved methods in handling his crop. It was thus with the object of tracing faulty methods or of determining how far present methods were supported by scientific knowledge that experiments were conducted both in the laboratory and in the packing-house.

Before starting these investigations some of the leading exporters were approached. They invariably welcomed any investigations, but none could mention any definite phase of the operations respecting which it was considered more knowledge was required, except one who thought he would like to know exactly during what part of the day he had to pick his grapes. Several appeared to consider that our knowledge of the handling had reached a high standard and that the main causes of wastage were to be found in cold storage and the length of time between picking and arrival on the London market.

In the experiments, Mr. L. Perkins attended to the practical part of picking, packing, etc., and Dr. De Villiers, Research Physiologist in Horticulture, carried out the laboratory experiments, and arising out of their respective reports the chief factors, which have been proved clearly to have a beneficial or a detrimental effect on the carrying qualities of grapes, are referred to hereunder.

Although for many years consignments of fruit have been forwarded to the Trade Commissioner and reports received about the carrying qualities of the different varieties, etc., the present was the first time that certain detailed information was asked for, but the reports received were not as detailed as required. This is a point that will be rectified in future. A consignment forwarded by the s.s. "Saxon" took twenty-seven days from Paarl to the London market, and arrived in a satisfactory condition, but a consignment twenty days later by the "Armadale Castle," which took twenty-four days from Paarl to Southampton, or practically the same time as the prior consignment up to the London market, arrived in a far inferior condition. In most cases the report was "damp, mildewed," or "showing signs of mouldiness, and in some cases even wasty." We are inclined to put down this difference in quality to the fact that the grapes were picked in the latter case twenty days later, in other words, the grapes were much riper. But in the sugar-percentage the grapes were practically the same. There was, however, a great difference in the outside temperatures at the time of picking.

Comparing the "Armadale Castle" with the "Medic" consignments, we find the latter took forty days up to Southampton, and yet the consignment arrived in practically the same condition, in fact rather better than the former consignment, although there is a difference of fifteen days in the time taken from Paarl to Southampton. According to some growers, these extra fifteen days turned the whole consignment wasty. Here again, the grapes had practically the same degree of ripeness, but at the time of picking the outside temperatures varied from normal summer temperature to the abnormal. In how far the cold storage of these ships affected the consignments we have no means of ascertaining; probably other authorities may be able to throw some light on this question.

The consignment per the "Diogenes" was all wasty. Here also the grapes were picked when we had abnormally warm weather, together with a thirty-six-days period before reaching Southampton.

The above suggests that abnormal summer temperatures may cause wastage.

TIME OF PICKING AND WILTING.

There is a great diversity of opinion among exporters as to the correct time to pick grapes and the length of time grapes must be allowed to wilt before packing. Some maintain that the best results are obtained if grapes are picked in the morning as soon as the dew has disappeared: others prefer to pick between 10 a.m. and 4 p.m., avoiding the cooler parts of the day. As to wilting, the time varies from nil to twenty-four, or even forty-eight, hours.

In our practical packing experiments we picked at about 10 in the morning and 4 in the afternoon. If experiments are carried out in the future, the different times of picking will have to be increased. The times for wilting are nil, twelve, and twenty-four hours. Unfortunately, not having received full reports from London, practically no concluions can be drawn, except that the different periods of picking during the day or the different wilting periods seem to have had no effect on the travelling quality of the grapes. If boxes differently handled had shown marked differences it would doubtlessly have been mentioned in the reports. Instead, the remarks applied equally to all the boxes of the same variety, from which it is concluded that different handling did not have much effect.

In the laboratory experiments Dr. De Villiers definitely shows that the most desirable time to pick grapes is about 1.30 to 2.30 p.m. In grapes picked at this time of the day, when the sap pressure of the roots is at its lowest, the berry will be least turgid, and so the movement of the pedicel is more elastic, allowing a certain amount of play to the berry without injury at the point of union between the pedicel and berry. Grapes picked at this time of the day also need be wilted for a shorter period than those picked in the early morning. The advice to growers that it is best to pick grapes during the hotter part of the day and wilt for twenty-four hours or more, has thus been proved to be correct, especially where the grower has not had wide experience. There is no proof that picking early in the morning or any part of the day, and packing without wilting, actually decreases the travelling quality of the grape, but it has been proved that the chance of injury, especially at the point of union between pedicel and berry, is greater, and this chance must be reduced to a minimum.

METHOD OF PACKING.

To-day two different packs are in vogue, viz.: the closed and the open pack. Our experiments have not given any definite results to allow us to declare in favour of the one or the other. Our London reports only once state that the closed slanting pack is preferred, yet make no serious objection to the other method. Dr. De Villiers maintains that it is desirable that the carbon dioxide given off by the grapes should get a chance to escape, and some oxygen allowed to get near the grapes. The open pack, therefore, would seem to facilitate this, yet in practice there seems to be little difference, probably due to the fact that even the open pack, which leaves the top of the bunch open, has an extra sheet of paper again put over it, practically making it a closed pack.

There is also the question of the quality of the paper to be used. A good quality paper will allow the gas and the water vapour to escape through its pores. Dr. De Villiers is still testing different types of wrapping-paper. Thus far the sulphite paper, largely used to-day, has proved fairly satisfactory. The object of allowing the air to circulate round the grapes may induce us to pay more attention to the way the boxes are nailed up.

THE DROPPING OF THE BERRIES.

Our laboratory experiments have proved that when the skin of the berry is slightly ruptured a fungus develops and causes the damage. The spores of this fungus are always present on the berry, but can only cause injury when the skin is ruptured. This injury to the berry is chiefly at the point of union between the berry and pedicel. This must be avoided as much as possible by wilting and careful handling of the grapes.

The laboratory experiments have further proved that big fluctuations of temperature after the grapes are packed are detrimental to the keeping quality of the grapes. When possible, the temperatures must be as even as possible, or better, have a gradual decrease, until the grapes reach the cold storage. It is recommended, therefore, that packing-houses should be well aired, especially during the night, so that the grapes may be packed with as low a temperature as possible; but we must strive to retain this low temperature or decrease it as best we can. The suggestion is made by Dr. De Villiers that as far as possible the export fruit trains should run during the night, and that where trucks are left standing at stations during the day they should be in a shed so as to keep the temperature as low as possible. The laboratory experiments have also proved that there is a distinct difference in the depth of the lignified sub-epidermal layers of good travelling grapes, as well as a difference in the rate of respiration. These facts are of value in testing new varieties. To-day the practical grape grower judges the travelling qualities by the appearance and firmness of berry, but ultimately it remains to be tested over several seasons before a true judgment can be made Through the laboratory we can to-day foretell in what class a new variety will fall even before any shipments have been made. Our experiments have proved that Rosaki, Barlinka, and Gros Noir have outstanding travelling qualities.

SUGGESTIONS.

The reports show that we have not yet solved the problem satisfactorily, though they indicate enough to prove the direction of our endeavours in future. It is evident that the Paarl Viticultural Station is not altogether suitable for practical packing experiments, as the quantity of grapes of any one variety in not sufficient. At least four or five shipments must be made with the same variety, in order to pick grapes at different stages of ripeness and provide several boxes of one particular pack. We must also be able to keep back a certain number of boxes in cold storage as a check on those shipped. It is unnecessary to experiment with a large number of varieties; three or four will probably be sufficient. If we can prove that Hermitage can always be landed in perfect condition in London, we can presume that grapes which are known to possess better travelling qualities will also carry satisfactorily if handled in a similar way.

It will be more satisfactory if such experiments could be conducted from different localities. Further experiments will again include: (*a*) Different methods of packing; (*b*) different periods of wilting; (*c*) picked at different times of the day; (*d*) picked at different stages of ripeness; and (*e*) stored at different temperatures (30° F., 34° F., 38° F. are suggested).

The experiments show that, to study the fundamental factors which determine the successful shipment of grapes, they must be on a fair commercial scale and carried out in close co-operation with the scientific aspect: the conducting of laboratory experiments helps to a great extent to solve this problem.

The scheme can only be undertaken successfully if we have: (1) adequate cold storage and temperature control; (2) the necessary material, i.e. a good supply of grapes grown under standard conditions; (3) assistance—expert and other.

As regards (1), it is hoped that the new cold storage at the docks and the refrigerating laboratory, which is now in the course of construction will cover the needs. With reference to (2), arrangements will have to be made with farmers, probably in different localities, to supply the grapes and to allow the harvesting and packing experiments to be conducted on their farms. As to (3), it will be necessary to procure the services of a well-trained officer who is capable of carrying out scientific research when given the direction of the investigations.

Fly Bait.

The mixture for fly bait is as follows:—4 oz. arsenite of soda; 3 lb. cheapest brown sugar; one paraffin-tin full water. Make a fresh mixture before each application, and spray the material twice a week on blue-gum branches suspended from above in the stable, byre, and piggery. Occasionally renew the branches. They should not be hung directly over cattle or feeding troughs. The material is very poisonous to cattle, etc. Possibly half this amount of the arsenite of soda and sugar will be equally effective. The more sheltered the branches are from sun and wind the more effective will be the poison. (*Elsenburg School of Agriculture.*)

DRIED FRUITS,

Their Standardization and Preliminary Grading and Culling.

By L. PERKINS, Dried Fruit Officer, Elsenburg School of Agriculture and Experiment Station.

A PREVIOUS article upon this subject dealing with prunes, apricots, peaches, and pears has met with a considerable demand both from packers of dried fruit and primary producers, and it is thought advisable to issue a further one covering raisins, sultanas, and currants. Standardization is essential, and self-explanatory charts will prove most useful to packers and growers alike. Preliminary culling controls not only the quality of the bulk delivered, but also to a very great extent the colour requirement. This is particularly so with small fruits such as raisins, sultanas, and currants. Once fruits of this nature, consisting of different colours and conditions, are mixed together in bulk it is almost impossible, if not commercially unsound, to attempt an assortment. Machinery being mechanical, all we can expect from it is the production of mechanical grades and the removal of undesirable dust and waste, but for quality we must rely upon the personal effort of the producer and packer. No machine can distinguish between light and dark coloured fruit, or slabs, culls, and good fruit.

Where, then, can this classification or preliminary grading be done? It is at this stage that the primary producer can aid the dried-fruit packer at very small cost. Culling is work that occurs in varying proportion on different deliveries, but it is part of a "live and let live" policy, where growers render the packers a service in return for which the packers should be prepared to pay. The best time to classify and cull raisins, sultanas, and currants is immediately before the fruit is picked up from the trays. It is just at this stage that one can easily distinguish the different colours and conditions of fruit. Moist bunches may be set aside for further drying, and light coloured bunches may be picked from among the bulk before scraping together. This does not involve a separate culling cost, but simply means a common-sense gathering of the fruit from the trays in classes. At the same time dark or blackened bunches may be detected and set aside for separate delivery, instead of mixing with the bulk. In sultanas, for instance, 1 or 2 per cent. of reddish or dark berries may spoil the rest of the bulk of a bleached delivery.

The general quality of our South African pack and its success on world markets lies almost entirely in the hands of the primary producers. Our machinery for mechanical grading is as modern and up to date as any in the world, but to those who handle the product and process it through this machinery must be delivered a product of quality. No amount of mechanical handling and manipulation will give the product the required quality.

It is not now intended to deal with the production and curing of raisins, sultanas, and currants, but rather with the question of the production of a better quality. We appeal to growers to improve their own product, and by so doing reap not only greater profits for themselves, but also the satisfaction of having delivered an honest, guaranteed, standardized pack.

In the accompanying colour charts, we have not only produced as near the ideal in each case as possible, but included also representations of lesser value, and each will be dealt with and judged upon its merit. We do not wish to convey the idea that every grower's delivery must necessarily be of this ideal classification, but with average care, all things being equal, there should be at least a great predominance of good fruits, particularly if the instructions of this bulletin are followed out, as hand-packing or culling will play a large part in the prevention of spoilage of the bulk.

The time has now arrived, owing to our increased mass production and the ever-increasing market demands by competitive interests upon oversea as well as local markets, when packers will be forced more and more to purchase principally upon quality, with the consequence that those who still continue to produce only an ordinary sample will be left with their crops. It therefore behoves primary producers to make a study of their local conditions and the subject of improved quality production, if they wish to participate in the profits to be derived from the sale of high quality goods.

RAISIN STANDARDIZATION AND CULLING.

In standardizing our raisin product many considerations of quality must be kept in mind, including principally condition of skin, colour, and meat; and of course in any grade the item of moisture-content is important

Standards and Colour.

By referring to the colour-chart it will be seen that there are represented there three colours (Fig. 1):—(1) Light amber, (2) dark amber, (3) very dark. Of these three, ligh tamber is the colour required for the best classification, and bunches representing this golden light amber should be picked up first from the trays before the bulk is scraped together. The very dark or blackened bunches should be sacked separately before delivery, and be delivered as such. Different colours, usually these three, are found on most drying yards, and by careful culling, the trade demand for a light amber-coloured fruit can be more easily fulfilled.

In order to obtain this light colour requirement for the best classifications a great number of factors need to be dealt with. It will suffice to mention at this stage that climatic influence, local or district conditions, condition of grapes at time of harvest, weather conditions prevailing at the time of curing, method of manipulation, all play a very large part in the production of this light coloured article, which upon arrival at the packing-house is classified under A quality.

In obtaining the correct colour requirement, a point to be remembered is the effect and use of a dirty lye. A very usual practice is to allow the lye to become thick, foul, and dirty before it is changed.

Consequently, if the fruit is not washed in clean running-water or frequent changes, the fruit is coated with a dark, dirty fluid. Not more than fifty trays should be passed through without changing the lye.

Another thing that affects the colour of raisins is the prevailing weather conditions during drying. Heavy dews and rain cause raisins to darken rapidly, so that care should be taken to stack should inclement weather be feared. It should be remembered that the shorter the period of time elapsing between the first day of drying and the last the better. For instance, should inclement weather prevail during the drying period, causing it to be lengthened to eight or nine days, the quality of the resulting product will be lowered. This factor cannot be controlled.

Meat and Fermentation.

The plumpness which signifies the meat-content of each delivery conveys immediately to the factory receiver the quality classification of each consignment. Raisins showing the shrivelled, baked appearance with lack of body are those which lack sugar, were made from green grapes, and can only be classed as C grade. With lack of sugar heavy fermentation will take place, causing great loss of weight. In order to obtain the maximum weight, grapes should be thoroughly ripe at the time of plucking, containing not less than 22 degrees Balling sugar, care being taken at the time of harvesting to select only the ripest bunches, leaving until a future date those bunches growing low down on the vine in a less favourable position. It is upon the fleshiness of the grape that quality is judged, and the light shrivelled bunches which so often diminish the value of the bulk should be culled from the tray. The A quality raisins should have a fine, soft, pliable feel, not at all tough and leathery.

Raisins which have been finished off in the stack or shade will present a much better "feel," and will show quality. This curing process prevents to a very large extent the rapid drying out and baking or "case-hardening" of the skin, and the resulting product presents a much more pliable, soft feel, which can only be likened to the true Valencia of Spain.

District Conditions.

District conditions play a very large part in the production of an A quality raisin, and there are certain areas better suited than others to the production of a really first-class article. Worcester and Robertson, towards Montagu, are the two principal areas at present, and for many reasons are likely to remain the most prominent for years to come. Even in these two large districts there are certain areas better adapted to raisin production than others. In districts where fall rains or thunder showers threaten the crop early in the season, and where the grapes commence deteriorating because of mould attacks and rotting, it is hardly likely that the industry will develop to the same extent commercially as in areas where beautiful sunny days and warm nights exist throughout the drying period. In order to secure themselves growers are apt to rush as much of their crop through the pots as possible, converting the residue to

wine. This procedure leads to many evils, some of which are the harvesting of green and ripe grapes together, excessive dipping and cracking of the berries to hasten drying, rough and slipshod manipulation because of the tremendous bulk to be handled in a short time, etc. Thus a classification of very ordinary and poor quality is obtained to the detriment of the better deliveries.

It has been observed that fresh grapes from certain areas have skins which are very thin and are most easily affected by lye, and it is to these portions of the district we must look for the production of our finer quality raisins.

Skin Condition.

As stated above, the skin condition varies in certain circumstances, which we may attribute to soil and climatic conditions. The natural skin of the grape is tender in the fresh state, but in varying degrees of tenderness, some being tougher than others. It should therefore be the aim of the grower to preserve this natural skin condition throughout the process of curing, keeping it as soft as possible and not endangering it to case-hardening. It should be looked upon as a covering for the pulp and juice, which, on the one hand, if shattered and badly split by over-dipping in the lye, will allow the contents to deteriorate and go to waste, while, on the other hand, if exposed to the sun for too long a period, its soft nature and finer qualities will be destroyed. Grapes which are over-dipped and have the skin condition spoilt will never become wholly dry, will remain sticky, and pick up a large amount of dust, dirt, and fluff; during storage the sugar granulates very rapidly, endangering to a very large extent the ultimate value. The finer these cracks or checks in the skin caused by the lye-dipping the better. In one way it is an unfortunate circumstance that makes it necessary to lye-dip for the hastening of the moisture evaporation from the grape, for it is at this stage that so much damage can be done; it is an operation requiring much experience, but one upon which few definite instructions can be given. One can but mention that this fine network of checks spread all over the grape should be of such a nature as to be hardly visible to the naked eye.

In order to obviate the other skin condition known as "case hardening," baking, or hardening, it is most necessary to finish the fruit off in the shade on the fourth or fifth day, according to previous weather conditions. This allows the drying out of the fruit at a slower rate, and also preserves the skin condition, as the skin remains soft. So often in eating a raisin there is left in the mouth a piece of tough, objectionable, leather-like skin, which instead should be soft and melting and capable of passing away with the meaty portion. A classification of this quality is only obtainable on a commercial scale by stacking.

Moisture.

Raisins should never be binned; in fact, should never be stacked in layers or heaps too deeply. However, the objectionable practice by some packers of using sacks for storage makes it imperative for growers to dry out their product thoroughly. The ideal method is to use sweat-boxes, and these will have to be used sooner or later by all factories in their own interests.

The best determination of dryness in raisins is to take a handful when cold and squeeze them firmly. If, when released, the fruit goes back to its original shape, showing generally the same wrinkled condition, it is as a rule sufficiently dry for handling; but if when released from such grasp it appears to be easily moulded into a new form, and adheres together as a mass, it is too moist for receiving. A few berries, if pressed tightly between the thumb and index finger, should exude no moisture, the inner meat appearing dry. In making this test one should always make allowance for warm fruit, for thoroughly dried fruit when heated up apparently becomes too soft. If fruit is received too moist, it necessitates boxing in sweats before cap-stemming, as it is impossible to carry out this operation with moist fruit. When delivered, the peduncle and pedicels should be bone-dry.

Owing to the fact that, unlike apricots, etc., it is impossible to green-grade the berries before drying, the fruits should be left upon the trays until the larger fruit is well dried.

Diseased Berries.

There is often a certain proportion of bunches and loose berries found in growers' deliveries which are either mouldy or diseased, as shown in Fig. 1; if present in any large proportion, they cause the bulk to be classified in a lower classification. Factory receivers should be careful not to allow this trash to be mixed with any bulk consignments because of the deleterious effect of mould. These "dops" or skins will probably blow over the screens, but mean loss of weight and increased cost of handling.

The entrance of this useless material into the bulk can be easily obviated with a little care by the grower.

During the harvesting operations the usual practice is to start at one end of the vineyard, harvesting all grapes—good, bad, and indifferent—as if for wine-making. Consequently, after dipping and drying we have upon the tray a miscellaneous collection of many classes of fruit, as shown on the colour charts. Definite instructions should be given the foreman in charge of the picking crew that only healthy, thoroughly ripe berries are to be harvested, leaving the green bunches for harvesting later on. This will mean going over the vineyard two or three times, but the grower will be repaid for his trouble by obtaining a better article. The diseased berries are usually from the lower portions of the vine, where the bunches drag upon the soil. It is not a costly or difficult operation every time a picker finds one of these bunches, to cut the diseased or foul portion away before placing the bunch in his picking-basket. Should a bunch or two be missed in the vineyard, they may be picked out on the trays by culling.

Sweating and Storage.

Generally speaking, when handling raisins it is advantageous for growers to sweat or cure their fruit prior to delivery to the packers, and this can best be done either in a closed stack, the contents of several trays on one, or preferably upon a loft. Many growers have a loft specially for this purpose, where raisins may be placed in layers not more than 6 inches when partly dry. This is an excellent procedure, providing the layers are not too deep. In this condition the fruit may remain for a considerable period to "even-up" in moisture-content. Deliveries should take place as soon as possible

after drying, but fruit in storage, particularly sultanas and raisins, should only be handled when cool. Farmers should be discouraged from storing in bags.

Mud Floors.

Opportunity is again taken to emphasize the fact that quality raisins cannot be produced on mud floors except under very ideal conditions. This is because, under unfavourable weather conditions, it is impossible to have proper control of the fruit. The question is often raised as to whether, by the use of washing-machinery, dirty raisins from mud floors could be made fit for human consumption. We give the assurance that it is impossible to recondition the first and second grade raisins by washing. Growers will find out sooner or later, in these days of keen competition, that very soon packers will be forced by market demands to disregard raisins produced in this way, purchasing only fruit produced in a clean, wholesome, and hygienic way. This method of production might have suited requirements of fifty years ago, but to-day the consumer's call is for a product prepared under the most wholesome and hygienic conditions.

SULTANA STANDARDIZATION.

Colour and Quality Standards.

In the standardization of sultanas, like that of raisins, consideration of quality falls under similar heads. First and foremost always is appearance, generally denoted by the colour properties of the fruit. The want of proper standardization in sultana products is probably felt more keenly than in most other fruits.

As to the colour desirable in dried sultanas, the grower does not always fully appreciate the standard that has come to be accepted in the trade. The first quality fruit is required to be of a golden-yellow colour. Certain sultanas in the bleached class dry almost white and some reddish. These may appear to be nice colours to the uninitiated, who are not familiar with the trade. Of course, the fruit will always have a portion of such specimens, but a real golden yellow must be considered as most desirable for quality fruit. With regard to the unbleached products, a bright colour, as shown in Fig. 2, is required for an A classification.

It must be remembered that as the colour of the fresh fruit is, so will the colour of the resulting dried product be. The bright yellow bunches will dry a desirable colour, while the bunches showing a greenish sheen will dry reddish or darker, as is shown in Fig. 2. No amount of sulphuring will alter this, and growers will therefore be compelled, as with raisins, to harvest first the bright yellow bunches, leaving the greener bunches for a later date.

Another all-important point in the production of a light coloured bleached article is the rapidity with which the fruit is manipulated through the different processes from the time of cutting until the fruit is sulphured. The most important stage in this manipulation is the period lapsing between dipping and sulphuring. The more rapidly this work is done the better, for immediately the tissue is exposed to the air after dipping, darkening takes place *immediately*. In this connexion we would advise the roofing over with "palmiet," straw, or rushes of that area occupied by the spreaders of fruit upon the trays

so as to prevent the rays of the sun coming into direct contact with the dipped fruit. The sulphur chambers should be prepared previously, so that no time is lost, the freshly cut tissues receiving the benefit of the sulphur-dioxide immediately.

It is important when considering points which affect the colour of bleached sultanas, to remember sulphuring. We will, however, deal with this under a separate heading.

When dipping sultanas, do not put more than fifty trays through without renewing the lye. Dirty lye aids the discoloration of sultanas in a very marked degree, especially if the fruit is not washed in clear water after dipping.

Sulphuring.

Only the golden-yellow well-bleached samples may be included in the A quality classification. This operation of sulphuring bleaches and fixes the colour, but, as stated above, no amount of sulphuring will improve green bunches which will dry to varying reddish shades, as shown by Fig. 2. Unfortunately, the majority of growers do not sulphur sufficiently. It is advised to use two pounds of rock sulphur per hundred cubic feet in order to get the desired effect, or for a chamber 6 feet high, 4 feet wide, and 10 feet deep (internal measurements), which equals 240 cubic feet, 5 lb. of rock sulphur.

Growers frequently complain about the burning properties of rock sulphur. Thorough combustion may be obtained provided the sulphur pot is not too deep and narrow. A flat plate with slightly raised edges is excellent, placing the rock sulphur in the form of a small horseshoe, igniting it at both arms so that it will burn, ultimately meeting. The usual trouble is that growers use holes in the floor of the sulphur chamber which are too deep. A large proportion of the burning sulphur melts. The molten lava flows over the burning and unburnt lumps, thus smothering the flames. To ignite the sulphur, a sprinkling of the finer wood chips and sulphur dust, together with a shovelful of ashes from the engine or boiler, will be all that is necessary. There are two or three other contrivances in use which are also good. An ill-fitting door is not an unmixed evil, as a little fresh air aids materially the thorough combustion of the charge.

While studying this subject of sulphuring in connexion with quality standardization it is necessary to draw attention to sulphur-chamber construction. Many of the sulphur houses now in use are obsolete, and when contemplating construction, farmers are advised to get in touch with Elsenburg School of Agriculture, when suitable detailed plans will be supplied gratis.

The smaller the space around the trays the more effective will be the fumes and the better the results. Apart from this important consideration is the unnecessary waste of sulphur. By the use of trolley lines the width from wall to wall should be only just sufficient to allow passage for the trays. The height of the roof should be so that the trays will just pass into the chamber when stacked fifteen or sixteen in number upon the trolley.

A further factor which plays a very important part in the production of A quality deliveries is the space which exists between the trays at the time of sulphuring. Overlapping or staggering the trays is not sufficient. Wood-pine spars a few inches longer than the width of the tray are required so as to leave a space of approximately 1 inch

between each tray. Immediately one tray is full, before placing the empty tray, one spar is put across each end of the full tray. The empty tray may then be placed in position. This will ensure thorough sulphuring, the fumes penetrating to all portions of the tray.

It is important to see that the largest bunches are broken up into smaller ones while spreading on the tray. Tight, large bunches do not sulphur well, especially if tightly packed together on the trays.

Skin Damage.

The same remarks as given for raisins apply to sultanas. It has been said that many of our poor-quality sultanas are produced through overdipping, or leaving the fruit in the lye for too long a period. Wide-bottomed flat wire-baskets should be used, and these should simply be dipped in and out, the lye being made of sufficient strength to allow this. Do not parboil the fruit; simply allow a fine network of cracks to appear, hardly visible to the naked eye.

Skin-shattered sultanas never dry properly, always remain sticky, and when stored produce enormous clods very quickly, besides picking up dust and dirt.

Moisture.

The subject of moisture-content of sultanas is very important, and the remarks made regarding raisins apply equally in the case of sultanas.

When grading the loads for general classification the grader also examines the fruit for moisture by feeling through the sack or sweat-box generally. Sweats containing any soft, green specimens, mildewed, "wet-looking" bunches or caked berries should on no account be received, but should be returned to the grower for treatment until dry; also any sweats containing bunches of tough-skinned berries which will not leave the stalk readily should be similarly treated.

Shade-drying and Stacking.

Part-drying of sultanas in the shade is as important in the case of both the bleached and unbleached as with the raisin, if not more so. In fact, this is a point greatly in favour of the Australian wire-method of drying the unbleached sultana. It is impossible to obtain the same bright colour if the trays are exposed to the sun for the total time of the drying period, and in the bleached quality many of the immediate tints between the golden and reddish would be more golden than reddish if this practice were indulged in. By utilizing the wire-method the berries are totally shade-dried, and it is very evident that this is very necessary, especially in the unbleached classification. It is therefore necessary to stack the trays immediately after dipping for a few days and then expose the fruit to the sun for the balance of the period. This saves time in hastening the drying, the old idea being to stack the trays the latter portion of the drying period, which necessitated several drying days lost to the grower. Stacking undoubtedly plays a very large part in quality production, not only regarding colour requirements but also body and "feel."

Meat.

The body requisite for an A quality classification is exhibited by plumpness of berry. Each sack or sweat-box in each consignment

should be examined by the grader. Sultanas should be graded into three general quality grades in both bleached and unbleached classes, viz.: —

First.—This grade consists of plump, fully sugared, meaty specimens, and, generally speaking, size does not count, although usually this grade contains the biggest berries.

Second.—This grade consists usually of smaller berries with a larger percentage of shrivelled specimens, which denotes lack of sugar.

Third.—Under this quality grade falls the remainder, and usually this grade lacks colour, contains gritty specimens, sunburnt berries, and the usual trash.

Culling.

This all-important operation should be done on the tray before the fruit is scraped together. It is at this stage that the three different colours, as exhibited in Fig. 2, can easily be detected and set aside in separate sacks. Any blackened or diseased bunches should be held over for separate delivery.

Sweating.

It is advisable to make delivery to the packers as soon as possible, but, failing this procedure, sultanas should never be cured in sacks, but be spread in layers, as advocated for raisins, on loft floors, taking care that the layers are not too deep. The "evening-up" process is very necessary in the production of a really good article.

STANDARDIZATION OF CURRANTS.

Quality, Standard, and Colour.

A distinct classification can be made between the Zante currant, or Corinth as it is called, and the ordinary Cape currant, which comes to us from some rather obscure source. There are numerous theories concerning its origin, some thinking that it is a sport from the Muscadel. There are, however, two or three differences, the most important being that the average Zante bunch yields more average sized, even berries, whereas the Cape currant gives a percentage of very large berries containing seeds, which spoils the general appearance of the bulk. The Cape currant also has a distinct muscat flavour, which is lacking in the Zante The Zante is a more tender, delicate flavoured fruit; the skin of the fresh fruit is thin and the pulp very sweet, with a strong flavour and aroma. The raisins are similarly aromatic and very sweet, sometimes semi-transparent, but generally dark violet. The skin of the Cape currant is coarser, less delicate in texture, but fairly strong in flavour. The difference is shown in Fig. 3. Whether Zante or Cape, only dark violet fruits can be placed in an A quality classification. The berries should be plump, well-dried; in fact, slightly hard. In no circumstances will a percentage of reddish berries or with a brownish cast be allowed to enter the A quality classification. A good sample should be perfectly clean, without any presence of stalks and cap-stems.

Drying.

In order to get the perfectly black or violet colour it is necessary to dry the fruit in the shade. The trays should either be stacked or else wire-frames constructed under cover. This is the only way in which the desired black or violet colour can be obtained without a large percentage of red berries.

Skin Condition.

In order to preserve the delicate skin, the fruit is cut from the vine when thoroughly ripe and placed without further treatment upon the trays. The more shade that can be given the better will be the skin condition.

Moisture.

Currants should be well dried. There is no danger if the currants are finished off on a loft until they rattle. On no account should currants of high moisture-content be bagged. It should be remembered that, in order to clean and cap-stem well, currants should be as dry as possible, without, however, spoiling the plumpness of the berry. It is therefore necessary to deliver the crop to the packers as soon as possible after it is dry.

(Coloured plates by Miss Lansdell, Division of Botany.)

Dried Fruit for England: Import Regulations.

The Minister of Health, England, has issued regulations, with effect from the 1st January, 1927, in regard to the sulphur dioxide content of dried fruit imported into England. The regulations prohibit the importation and sale of articles of food to which preservatives and other specified substances have been added. They empower officers to take such samples as may be necessary of consignments of imported articles to which the regulations apply for the purpose of analysis and control generally of the importation of the articles subject to the regulations.

Included in the schedule of articles affected are the undermentioned. They may contain the preservatives of sulphur dioxide in proportions not exceeding the number of parts (estimated by weight) per million as specified below, viz.:—

Article.	Parts per Million.
Fruit and fruit pulp not dried:—	
Strawberries and raspberries	2,000
Other fruit	1,500
Dried fruit.	
Apricots, peaches, nectarines, apples, pears	2,000
Raisins and sultanas	750

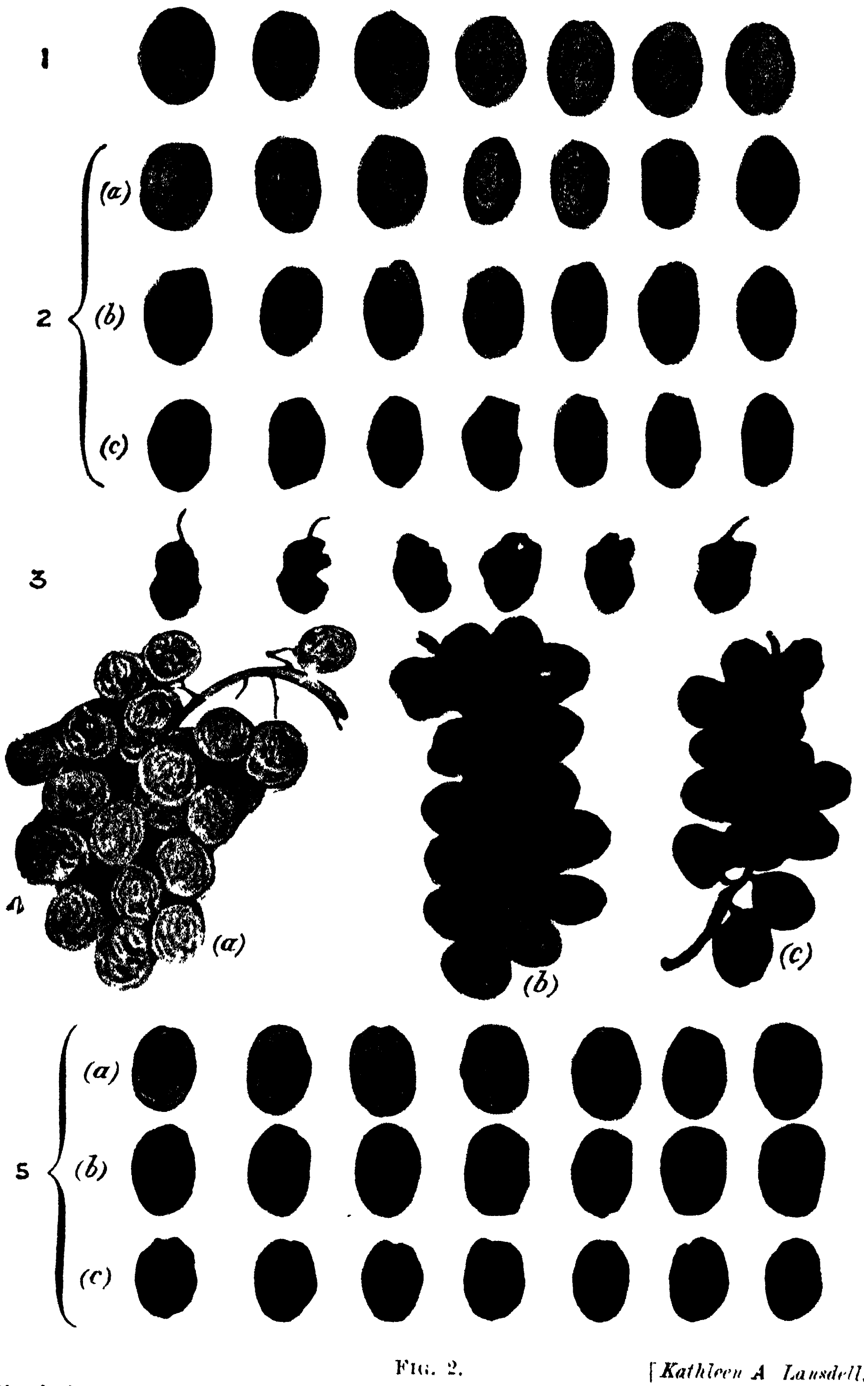


FIG. 2. [*Kathleen A Lansdell.*

Bleached Sultanas:—1. A quality golden yellow; 2. Undesirable colours produced from varying degrees of ripeness; 3. Diseased berries; 4. (*a*) Light golden, (*b*) Amber (produced from green fruit), (*c*) Blackish brown (produced from very green fruit); 5. Unbleached Sultanas:—(*a*) Light, (*b*) Medium, (*c*) Dark.

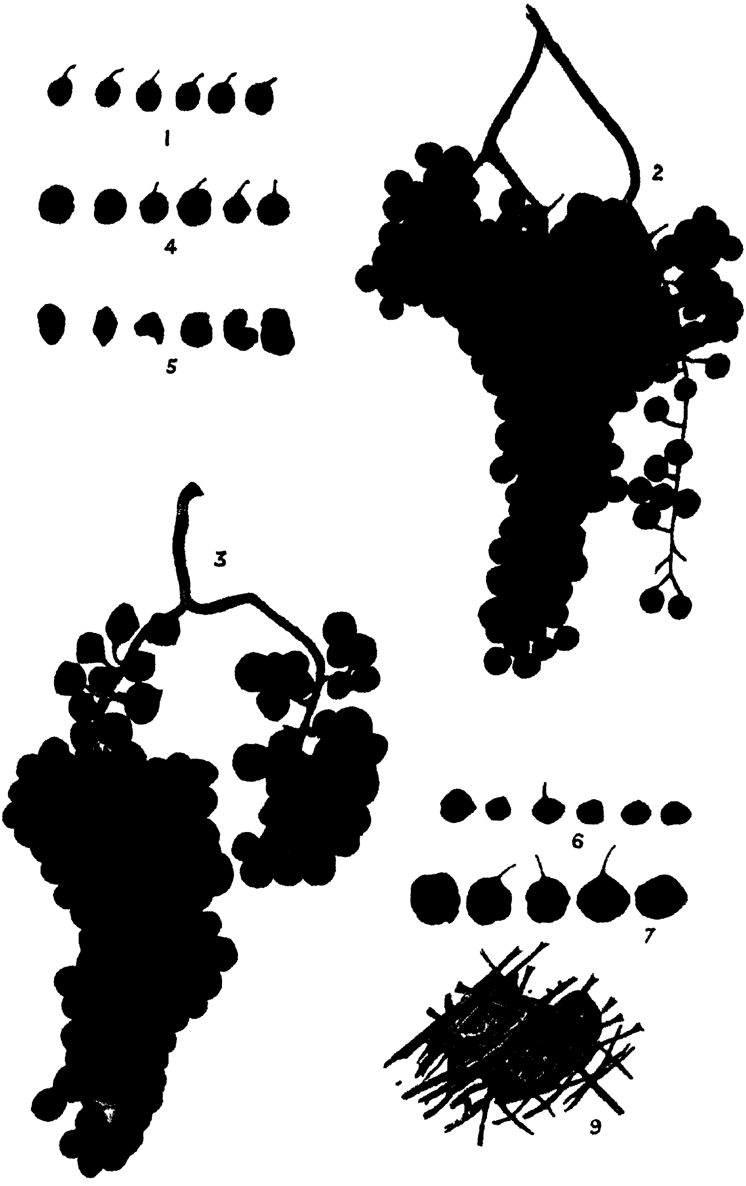


FIG. 3. [*Kathleen A. Lansdell*

Currants:—1. Zante Currants (note uniform size): 2. Typical Zante bunch showing evenness and good black colour of berries: 3. Typical Cape Currant bunch, undesir-able large size and unevenness of berry compared with Zante Currant: 4 Cape Currants (large uneven size compared with Zante Currant): 5. Dried-out skins, lacking plumpness; 6. Berries of Cape Currant showing reddish cast: 7. Cape Currants produce a fair proportion of these undesirable large berries (natural size). 9. Grading waste.

THE GREAT DROUGHT PROBLEM OF SOUTH AFRICA.

VII.—A Safe Insurance in Fodder Reserves.

MISPLACED HOPE.

SPECIAL attention was given by the Commission to the question of feeding by the cultivation of grasses, and it states that there is not the least doubt that in an *adequate* reserve of fodder lies a most effective insurance against stock losses in drought. Yet our farmers show a deplorable lack of foresight in making such provision. Although they all agree that drought, bringing losses to stock through lack of grazing or water, is to be expected three out of every five years, they invariably say that they make no special provision for the dry season. Nor do they realize that the dry years are actually the normal years, while those with adequate rainfall are in the minority. Instead, they cling to the idea that the good year is the normal or usual one; and thus in this misplaced hope they continue to overstock, and fail to provide reserves of fodder for the bad seasons.

There are exceptions of course, but even such farmers as do grow fodder are frequently forced to turn their hay into money, and often, fearing a fall in prices, they rush their accumulated fodder to market, hoping that the coming season will be favourable. Too often it is the reverse: the expected good season turns out a bad one, while the anticipated slump in the market has not taken place. Indeed, owing to scarcity, there is a marked rise, and the farmers have actually to buy food for their animals at soaring prices. Herein is a reason why ensilage is highly recommended as a reserve for drought times. While it keeps good indefinitely in the silo, it goes bad shortly after removal therefrom, and must, therefore, if at all, be consumed on the spot.

THE RESERVE PADDOCK.

If the farmer would only realize the truth of what he admits, that drought conditions are to be regularly expected, it will be a step in the right direction. He will then surely provide against the season of scarcity. The first and simplest of fodder reserves is that of the "spare-camp" or reserve paddock. A further wise precaution is a discreetly stocked farm. This plan is applicable to all farms, but particularly those having a low rainfall and little chance for irrigation.

THE SEED CAMP.

There are many farmers who think that the present-day conditions that prevail in the Karroo are what they always have been. This is not so: they are worse. In general the individual Karroo bushes are old: they have gnarled, stunted, and distorted stems, a dense growth of short twiggy branches, and a deep root system. The

scarcity of seedlings, and especially of young plants, is most noteworthy, and points to the fact that Karroo bushes are not regenerating fast under present conditions. The example of a well-known farmer on the border of the Somerset East and Jansenville Districts, who is alive to the position, is given to other farmers similarly situated. This farmer has established what he calls a "seed camp," a small area to which access is possible only by climbing over or through a wire fence. Here, year in and year out, the veld is untouched by stock, and thus the various plants have the fullest opportunity of growing naturally and producing seed. And from this area spread the seeds of the palatable plants to other parts of the farm. The Commission recommends, as a matter of general interest and educative value, that every Karroo farmer should have at least one "seed camp" on his farm. One morgen, or even less, would be sufficient, and it should be enclosed so as to make it impossible to drive stock into it.

HAY FROM VELD GRASS.

A second method of creating a fodder reserve is to make hay from veld grass. This, of course, is practicable on a large scale only in the grassveld, provided machinery can be used. Many farmers stated that the cost of such machinery which, moreover, stood idle for a large portion of the year, deterred them from the practice. On the other hand, the scythe costs little, but is not to be despised as a mowing implement when labour is available.

CROPS FOR FODDER.

To grow "artificial" fodder crops is a third method of providing for the time of dearth. Here rainfall, temperature, irrigation possibilities, purpose for which feeding is needed, and so on, must be considered. A large variety of crops is at the command of the farmer. There is, for example, the Mesquite bean, a tree which furnishes valuable fodder, grows rapidly under extremely arid conditions, and, owing to its formidable thorns, does not require protection from stock. Then there is lucerne, the king of fodder plants, which requires good and deep soil for the best results as well as a bountiful water supply. Rye is hardy, does well even on poor soils, and furnishes excellent winter grazing where there is winter rain, where autumn rains are sufficient, or where irrigation is possible. Emmer wheat falls more or less into the same class as rye. Of grasses, Paspalum thrives even on sour soils; Kikuyu tolerates a moderate amount of brak, and furnishes excellent fodder, but is nipped by frost in winter; Sudan grass, a species of sorghum, is a free grower, and gives a fairly good hay or ensilage when properly treated. Maize can be grown for grain in all parts where the rainfall is favourable, both as to season and quantity; the stalks remaining after the cobs have been removed furnish excellent and palatable roughage, especially if they are cut off and stacked. Maize, moreover, is the king of ensilage crops, and can be grown for this purpose in many parts where the rainy season is too late for growing it for grain. Besides these there are the American aloe (*Agava americana*) and the prickly pear, of which there are spineless varieties. Both these grow well in dry climates, and are frost-resistant. Unless

looked after like other crops, these cultures cannot be counted on to make rapid growth; especially does this apply to the aloe, but both have the advantage over other crops that they are available for fodder purposes at any time, and are, therefore, pre-eminently a stand-by in times of drought.

Many stock farmers have gone in for and derived benefit from imported fodder shrubs, grasses, and so on; but too little attention, from a stock-feeding point of view, has been devoted to indigenous varieties. However, investigations into the feeding value and other properties of our own South African fodder plants are proceeding, while private individuals have started "Karroo gardens" with a view ultimately to establishing the best varieties on the veld where only useless species now grow. If this objective be attained, it is obvious that the stock-carrying capacity of such veld will be increased. Controlled grazing will also probably result, and with it the re-establishment of the vegetal cover and the retarding or stopping of soil erosion.

DROUGHT-RESISTANT FODDER PLANTS OF ALL KINDS.

Reference is made by the Commission to our various drought-resistant and edible native plants, such as appelbos, brosdoring, beesbos, driedoring, gemsbok bean, etc., and the report contains lists of these and information on their properties, habits, etc. Certain details are also given in regard to several of the exotic drought-resisting fodder plants that have been imported and experimented with, such as the American aloe, the Carob tree, the Mesquite, the soap weed, etc. A paragraph is also devoted to certain grasses, both exotic and indigenous, such as Marram grass, Napier fodder grass, Molasses, Pennisetums, Natal grass, etc. Valuable hints are given in regard to these various plants. In addition, the report contains a comprehensive series of maps, which indicate the agricultural and pastoral industry of the Union better than anything hitherto published. Altogether, the Commission strongly urges the study of the principal Karroo and other indigenous plants, with a view to improving and spreading those that are useful and to restricting the spread of those that are useless or noxious, since, owing to limitations of rainfall, it is highly desirable that the veld should consist, as far as possible, of fodder plants only, and, further, only of those fodder plants whose efficiency in using rainfall is high. It recommends that every endeavour be made to improve on indigenous species rather than, as appears to have been the custom in the past, to look exclusively to exotics for betterment.

A GAP TO BE BRIDGED.

Mention has already been made of the stock farmer who, perhaps pressed for cash, has sold his fodder and then found the need of it when the dry season has overtaken him. Usually, however, where stock losses are heaviest in drought, crops are not easily grown owing to want of sufficient or favourable rain. Even when the crop-raising capacity of the farm has been fully developed, it may be impossible to accumulate a reserve sufficient to feed all the stock through all droughts, especially if the latter follow one another closely. There are stock farmers who are able to, and do, provide

sufficient fodder for drought times, but generally the farmer who can produce fodder for stock is not the stock farmer, and there is no organization knitting together the interests of these two main branches of farming. A good season for the stock farmer means a glutted fodder market, while a really bad drought so puts up the price of fodder that its purchase to save ordinary stock is out of the question. Again, while the stock farmer will perhaps store fodder which he has grown himself, he does not purchase it against future droughts, nor will the other farmer produce fodder in years of plenty with the hope of selling it to the stock farmer in the time of drought. The crop producer does not consider the stock farmer a possible customer; instead he looks rather to export to solve his market difficulties. Yet the gap now existing between these two classes should be bridged.

A FODDER BANK.

Unless something is done to bring the interests of both classes into line, it is likely that the crop producer will continue as at present. The solution of the difficulty lies in the establishment of what is named a " Fodder Bank." Alternations between famine and plenty have for ages been experienced in Africa. In Biblical times special steps were taken to tide the people through the lean years, steps which, with but little amendment, could be applied to our own farming industry to-day. In Genesis it is written: " Let Pharaoh . . . appoint officers over the land, and take up the fifth part of the land of Egypt in the seven plenteous years. And let them gather all the food of those good years that come, and lay up corn under the hand of Pharaoh, and let them keep food in the cities. And that food shall be for store to the land against the seven years of famine, which shall be in the land of Egypt: that the land perish not through the famine."

A LESSON FROM THE BIBLE.

This quotation is a good picture of the type of organization the fodder bank would be, the underlying principle of which is simply the accumulation of fodder during good years and holding it in bond until the next drought, when the bank would sell to the stock farmer at a basic price, plus interest and other charges. Such price would certainly be much lower than the famine prices now paid, because there would be no scarcity. Once a reasonable price is assured the crop-raiser, he will doubtless find it advantageous to produce more fodder than at present. Whether the country is ripe for the institution of a fodder bank or other equivalent organization, the Commission does not say, but it finds that such an institution is needed, even as in the days of Pharaoh, and that the State should take the lead and discover the Joseph necessary for the organization of such a venture.

THE HISTORY OF THE VEGETATION.

A complicated but highly interesting matter that impressed the Commission was the study of succession in plant communities; that is, the indication of the progress or otherwise of the veld as shown in the presence of certain plants. Given very favourable climatic conditions, Professor Bews records that our onward progress takes place

in the following order:—(1) Wire grass grassveld; (2) rooigras grassveld; (3) tamboekie grass grassveld; (4) scrub; (5) low forest; (6) high forest. This means that grassveld in which wire grass is dominant is a more primitive type than grassveld in which rooigras is dominant, and so on. Thus, if wire grass becomes dominant where rooigras had been supreme, retrogression has taken place, denoting less favourable climatic conditions; if, therefore, the proportion of wire grass (which includes varieties locally known as steekgras) is increasing, it would be an indication that there is over-stocking, and so of retrogression.

This indicator has been observed in other countries. In America the spread of prickly pear in grassveld is a warning of overstocking, and this, no doubt, is true also in South Africa. Now, the Karroo veld contains types much more primitive than wire grasses. If, therefore, in Karroo veld the proportion of grasses increases, better conditions are indicated, but if inedible or unliked growths, such as bitterbos, are crowding out, say, the true sheep Karroo bush, then it is a sure sign that overstocking has become a deep-rooted practice. If tamboekie grass increases in rooigrass grassveld, it is an indicator of progress, of increasingly favourable climatic factors; yet to a stock farmer this would seem retrogression, for the rooigras is the more valuable of the two. The farmer should therefore stock more heavily or take other means (occasional burning is mentioned) to cause retrogression.

It will be evident that a study of plant succession holds tremendous practicable possibilities applicable to the South African veld.

A FIRST PRINCIPLE.

As a result of very close consideration of the position generally, the Commission makes the recommendation that farmers should provide such fodder reserves as may be possible under existing conditions. It gives in the report practical advice on the subject. It is a matter indeed that is constantly being urged by the State, and one, it is trusted, that will speedily be recognized by stock farmers as a first principle in animal husbandry in South Africa.

(NOTE.—For further details read Chapter XXXIV of the Final Report of the Drought Investigation Commission.)

(To be continued.)

Fruit Export, South-West Africa.

By proclamation in the *Government Gazette*, the Mandatory Territory of South-West Africa is exempted from the Fruit Export Act, No. 17 of 1914, which governs the export of fruit to countries oversea.

THE CULTURE, PICKING, PACKING, AND SHIPMENT OF TABLE GRAPES.

By FRANCOIS J. DE VILLIERS, B.A., M.Sc., Ph.D., Research Physiologist in Horticulture, Elsenburg School of Agriculture.

INTRODUCTION.

IN this chapter* the writer intends giving a short survey of the most essential points the producer should bear in mind, if he wishes to be a successful competitor in the industry and make his methods of production and marketing economically sound. In this discussion fundamental principles alone in so far as they affect the industry are considered, without giving a definite and detailed set of rules to be strictly followed. For this purpose the useful information derived from Chapters I-VIII is made full use of, and in this sense points to the practical value of such laboratory experiments.

LOCALITY.

General.—Though grapes are grown in all four Provinces of the Union, by far the major portion is produced in the south-western districts of the Cape Province. Climatic factors have in the main determined the localization of viticulture to this part of the Union, and the ideal weather and soil conditions which exist for grape production have made the industry of prime importance to this section of the community.

At present viticulture is chiefly practised in the following localities:—Constantia, Stellenbosch, Paarl, Malmesbury, Tulbagh, Ceres, Montagu, Robertson, Worcester, and Graaff-Reinet. Each of these areas has its particular and characteristic climatic conditions during the different seasons of the year. For example, Constantia vineyards experience the sea and coastal influence to a marked degree, whereas Robertson and Worcester again are typically inland districts. Intermediate between these two extremes are Stellenbosch and Paarl.

Rain.—In most of the south-western districts the rainfall is abundant—20-30 inches per annum, though in the Worcester and Robertson districts the rainfall does not always reach 15 inches and summer irrigation is, therefore, a common practice of the viticulturist. Rain acts deleteriously on table grapes, although a light rain during the early summer months may stimulate sap movement

* This chapter is extracted from a comprehensive paper by Dr. De Villiers, entitled "Physiological Studies of the Grape," which the Department proposes to publish as a Science Bulletin. The extract now published should be read in conjunction with the report (also published in this issue of the *Journal*) by Mr. Van Niekerk, the Government Viticulturist, on certain experiments carried out last season in regard to the wastage in export grapes.—EDITOR.

in the vine, and by causing swelling of the fruits, aid in the production of large-sized berries. In general, however, localities experiencing summer rains should be avoided.

Ripening Period.—Even in such a comparatively small area as that to which grape-growing is confined, there are marked differences in the ripening period of the fruit. The Paarl and Malmesbury districts are no doubt the first to market grapes. Tulbagh is somewhat later, whereas Constantia and Worcester, Ceres, etc., have their grapes ripening towards the end of February, the vintage taking place during March.

Where grapes ripen very late in the season there is the danger that autumnal rains may spoil the crop, or at least handicap the production of raisins. In choosing a locality this should be borne in mind, especially where grapes are grown for export, and early ripening varieties should be selected in such areas.

Temperature.—It is only in the inland districts mentioned above and those having high altitude that there is danger of spring frosts. In summer time these areas generally have high temperatures during the day, but the nights are cool, and dew is often heavy; whereas in places like Paarl, while the temperature also rises to a high degree during the day, 95° F. to 104° F., the humidity only occasionally reaches 100 per cent. during the night, and dew deposit during the night is, therefore, less common.

Where spring frosts occur, judicious pruning may prove of help—late pruning will cause a delay in sprouting and hence the vine may escape the frosts of spring. Later varieties will also be found more suitable as their young shoots will generally appear after the spring frosts. These young growths of spring have a low cell sap concentration and are, therefore, readily affected by low temperatures.

Temperature and rainfall are no doubt the determining factors in grape culture. Though there are some varieties which get badly scorched during very hot days, the temperature of temperate and sub-tropical regions hardly ever reaches a degree high enough to affect the crop injuriously.

Low temperature is most often the limiting factor. European writers have repeatedly remarked on the influence of temperature on the growth and production of the vine. Most of them consider that the mean temperature of the growing season must be at least 59° F. and of the summer 65°-67° F. to produce vinifera grapes. Besides a warm summer, a mild autumn free from continued low temperature is necessary.

At Constantia instances were observed where a brief spell of cool weather has markedly retarded the ripening of Raisin Blanc. Low temperature is a stimulus in so far as the root pressure, consequent sap movement, and general growth processes are retarded. The retarded ripening indicates a slow recovery to the normal under the favourable conditions of warmth applied after the low temperature stimulus.

Heat requirements for grapes during the growing season can be understood best from European experiences, since the climatology of this fruit has been studied most extensively there. Along the doubtful zone of grape-growing the careful selection of site is emphasized.

Humidity.—Humidity may also prove a limiting factor in grape culture. High moisture-content of the air favours fungous diseases. For example, Oidium and Anthracnose are prevalent in the Constantia vineyards.

In such areas there is also an increase in leaf surface, and the fruit often shows a russeting effect. This russeting may be accompanied by cracking and malformation of the fruit, resulting in considerable loss. It has been noted that cork pustules are often developed on the pedicels as well as on the fruit under such atmospheric conditions. The cork generally starts to develop under the stomata.

High humidity effects seemed to be caused primarily by a decreased light supply, and the interception of light by water vapour may explain many of the local differences noted in grape culture.

Situation.—Avoiding low lying valleys for grape-growing may in part be due to high humidity. The best quality grapes are grown on the slopes of hills. A north-south or a north-east slope is to be recommended. Valleys, though they yield larger crops of grapes than similar areas on hill-sides, must yield the palm of quality to the warm soil of the slopes. Especially in table-grape culture, the grower must be prepared to sacrifice quantity for quality. Coloration and skin development, besides other qualities which characterize a good marketable product, are peculiar to grapes grown on the slopes.

COLOUR OF THE GRAPE.

The colour of the berry primarily determines its attractiveness, and it should be the aim and object of the grower to have the coloured varieties of his grapes the darkest shade of their characteristic colours when mature and ready for export. There are several factors concerned in the pigment development of grapes. As yet those factors which have dominating influence have not been definitely determined.

Preliminary experiments and observations, however, have shown that (*a*) certain varieties, like Red Hanepoot, develop much better colours in the Constantia area than they do at such places as Paarl; (*b*) dark coloured grapes like Gros Colman colour up well in both localities; (*c*) aeration, i.e. a good supply of oxygen, is essential for colour development, as oxidation by the enzyme oxidase is one of the processes of normal pigmentation; (*d*) light does not seem essential for all varieties as regard colour development. The effect of light needs further investigation; (*e*) acidity changes result in corresponding changes in pigment, and various shades of colour may be obtained by varying the acidity; (*f*) in the writer's estimation *nutrition*, and hence such factors as soil, fertilizers, etc., are most important. At present it seems that certain mineral constituents are essential for pigment formation and that the shade of colour varies primarily with acidity.

PROPAGATION AND CULTURE.

Soil.—Most of the soils on which our vines thrive have been formed from sandstone, granite, and shales. Of these, decomposed granite, such as occur on the slope of Paarl Mountain, furnishes the best soils.

Almost any soil, however, which does not hold excess of water or is not tainted with alkali will do for the vine, although the plant appreciates good deep soil. Of course the economic question of ease of cultivation enters into the choice of soil for the grape, but its claims are obvious and need not be enlarged upon.

Varieties.—In planting grapes in doubtful situations much depends on the choice of the proper varieties. In places like Paarl, where the temperature in summer often reaches a high degree, as has been pointed out above, varieties liable to scorching, such as Flaming Tokai, should be eliminated, and in such areas the dark coloured varieties are best, whereas those varieties, such as Red Hanepoot and Flaming Tokai, which assume a red or violet colour when ripe, are best cultivated in localities like Constantia, where highest development of their colour takes place.

Varieties should also be selected which have diffeient ripening periods, i.e. the exporter should have grapes ripening (1) early in the season, (2) in mid-season, and (3) late in the season. In this way more or less continuous harvesting can take place for six, seven, or more weeks, without having to handle excessive consignments within a limited period. In cultural practice, especially with respect to thinning of grapes, it is also advisable to have grapes maturing at different times.

Vines sprouting after the spring frosts and maturing their fruit before the autumnal rains are to be preferred.

Stock.—All grapes should be grafted on Phylloxera-resistance stocks. These American stocks will not appreciably affect the type or amount of crop, provided proper cultural practices are employed. In fact, by intelligent selection of stocks decided advantages may be gained, especially with respect to increased vigour of growth and production. It is advisable to consider the type of soil and its water relations before deciding on any particular stock.

The susceptibility of *Riparia* and the immunity of *Rupestris* stocks to drought have been attributed to the shallow roots of the former and the deeply penetrating roots of the latter. In poorly drained soils where the water table may rise and remain high for a fairly long period, these same peculiarities tend to reverse the order of suitability.

Congeniality between stock and scion is of course an important consideration. It has been stated that in some cases *court noué* in the grape may be traced to grafting, and is due to a kind of physiological trouble induced by osmotic changes caused by the union of plants of different chemical functional capacities.

Various influences of stock on scion and vice versa have been noted, but most of these may be explained by considering the change in vigour resulting from the union of different stocks and scions as producing such effects. This action on vigour may be direct when the two parts of the graft are congenial and make a good union, or it may be indirect when there is poor affinity between stock and scion and the union is poor.

It would be beyond the scope of this paper to enter into the different methods of manuring, cultivation, pruning, etc. A few points may, however, be noted in this connexion.

Pruning.—Though a large proportion of the grapes which are shipped from California are grown on short-pruned vines, in South Africa trellising of the vine has been found the best practice for producing grapes with the desired qualities. The rows are generally eight feet apart, and the distance between individual vines may vary anywhere between four to eighteen feet, depending on the type of growth of the particular variety.

Winter pruning may be done—at least in frostless localities and with varieties which set their fruit well—at any time when the vines are without leaves. Where spring frosts are common, such as in the Warm Bokkeveld area, pruning should be delayed until the buds begin to swell, because late pruning also delays the blossoming, though somewhat less than it does the time of sprouting.

Whatever type of winter pruning is adopted, careful summer pruning, suckering, and topping are necessary for the best results.

Summer pruning, if done early enough, i.e. while the growth is still soft at the point of removal, will induce the growth of laterals and will shade and improve the fruit, and at the same time thicken the growth of the main cane, and strengthen its connexion with the spur. The first summer pruning should be done soon after blooming.

When vines are pruned too late in the season, then the removal of the leaves, the food factory of the vine, often seriously checks growth, and in hot regions induces sun-burn, whereas when the shoots are pruned when young the food materials that would have gone into that shoot are diverted to the shoots which remain, and the vigour and size of the latter are consequently increased.

Over-pruning reduces the crop and the energies of the plant are largely used in excessive wood growth. Under-pruning permits the plant to over-bear, resulting in too many clusters, undersized berries of inferior quality, and the weakening of the vine itself, so that succeeding crops will be reduced in size and the life of the plant shortened. Pruning is thus an excellent measure for regulating the amount of growth and type of grape produced.

The type of product may be further modified by the process of thinning the grape in its immature stage, and for export this becomes an essential treatment.

Thinning.—The market demands a moderately sized bunch, 1-2 lb., with large uniform and well-coloured berries. The process of thinning of the immature grape is an excellent means of making the mature product attain and acquire some of these qualities.

The first thinning takes place very early in the season. At this time a very large percentage of the berries are removed, 40 to 60 per cent. Special attention should be given to the *shape* of the bunch; heavy shoulders should be cut off, as also long tapering ends. It is best to remove all surplus bunches very early as they will compete with those grapes which are on the same vine and are intended for export. In this industry the grower must be prepared to sacrifice quantity for quality, and the capacity of the vine to mature a certain amount of produce with the desired qualities is limited to a certain maximum.

In the second thinning the distribution of the berries should receive primary consideration. This is the time the bunch is moulded, hence only skilled labour should be employed.

A third thinning is often necessary to remove undesirable berries, such as extra small ones and those which have become scorched.

Harvesting.—No definite and reliable criterion has as yet been postulated as regards the right stage when grapes are in *optimum* condition for harvesting, i.e. to pick grapes when they have maximum keeping quality and good colour and flavour.

Various chemical analyses of the different stages of the maturing grape have been made by several investigators. As yet it has not been possible to use such information as a basis for a simple and reliable test, which the grower can use to determine the stage of ripeness of the fruit. The criteria commonly in use at present are size of berry, its colour, and sugar-content. These are, however, somewhat unsatisfactory, though the sugar-content test has some value.

It has been observed that grapes undergo a definite set of fluctuations in turgidity during maturation, and this fact seems to suggest a practical test. From a few preliminary experiments it was found that the firm, hard berry, when green, loses its turgidity at the time when rapid swelling takes place; then follows a period when the fruit becomes and stays firm for a while. This latter period has thus far been found to be the best period to pick grapes for shipment. This firmness diminishes after a time, and, though the fruit may appear in excellent condition, marketing of grapes at this stage of their life is speculative, since they generally have a poor keeping quality, and the berries show a tendency to sever readily from the bunch.

BEST TIME OF THE DAY TO HARVEST GRAPES.

As yet the farmer considers only two factors when he decides what time of the day he is going to pick his grapes: (1) He generally attempts not to pick grapes during the hottest part of the day, but (2) starts operations as soon as the dew is off the fruit.

Experiments conducted in this connexion have shown that the ideal time to pick grapes is at thermal noon, i.e. between 1.30 and 2.30 p.m. At this time of the day the relative humidity generally has its minimum value and so has root pressure, while the temperature is at its maximum. That is, at thermal noon of every twenty-four-hour period the grape is not only receiving the lowest supply of nutrient (low root pressure), but loss of moisture is at its maximum (high temperature and humidity); these factors have a resultant effect of causing minimum turgidity of the berry at this time of the day, and the fruit is, therefore, in optimum condition for harvesting. It must be borne in mind that the lower the turgidity of the fruit the greater elasticity of movement of the pedicel is possible without causing rupture at the point of attachment with the berry. Furthermore, the period of wilting of grapes picked in such a condition will be appreciably shorter. As yet the deleterious effects on the fruit, resulting from harvesting grapes during the hottest part of the day, have not been observed, though the blotches appearing on the skin of Waltham Cross and Rosaki may be one of such results.

WILTING.

The more hardy varieties with their tough skins have a very low rate of transpiration and lose moisture very slowly. In the case of

such varieties it is advisable to prolong the wilting period somewhat. The grapes are often packed immediately after picking, since their resistant skins and firm pedicel attachment lower the risk of injury markedly. Wilting, however, is recommended for all varieties.

Wilting is especially necessary for the more tender grape varieties, and the period will vary with the humidity and temperature in the packing shed where the grapes are spread out in trays. Ventilation markedly accelerates the loss of moisture from the fruit. The period grapes are thus left after harvesting before packing will also vary with the particular variety; and even the locality where grown should be considered. Forty-eight hours may be considered a minimum period.

Rain lowers temperature and increases humidity, thus diminishing the rate of transpiration. Root pressure is increased by rain or irrigation; and all these factors combine to produce a highly inflated or turgid berry—a most undesirable product for export. Harvesting should, therefore, be delayed after rain or irrigation and the period of wilting in the packing shed prolonged.

The effect of rain or irrigation will vary with (*a*) the variety and its maturity, (*b*) type of soil.

As the grape develops lignification and toughening of the skin take place. The elasticity of the skin diminishes, and when the roots of the vine are irrigated and the fruit receives an increased supply of nutrients the berry becomes inflated and the skin is in high tension. Grapes like Gros Colman with a thick inelastic skin readily give way under the strain and burst. Other varieties with more elastic skins like Hanepoot, as also the immature berries, only expand.

Irrigation also acts deleteriously on the inherent keeping quality of many varieties of grapes. Varieties like Hanepoot acquire a higher degree of succulence with a consequent loss of "fleshiness," which latter characteristic is so essential to a good shipping grape. Some varieties, however, can be irrigated and yet be exported profitably; as examples Barlinka, Waltham Cross, and Rosaki may be quoted.

In a well-drained soil the excess moisture readily disappears. The rise of sap in the vine is thus only temporarily stimulated, and there is thus less possibility for causing high inflation or bursting berries. Recovery to the normal condition is rapid within a few days.

Where the soil has a high retentive power for moisture, the effect is intensified by the consequent prolonged stimulation of sap movement. In such cases berries often rupture, and recovery to the original degree of turgidity is slow. Harvesting of grapes have, therefore, to be delayed often for eight days or more.

In dry and fairly hot climates loss of moisture from the fruit is comparatively rapid, and in such cases grapes may be harvested two or three days after a rain, though four of five days may involve less risk.

PACKING.

Each farmer has his own method of trimming, wrapping, and packing grapes, and he is tardy to accept novel methods as substitutes for those born of many years of experience. No attempt will here be made to lay down any hard and fast set of rules—before this

can be done much more investigation will have to be carried out. A few suggestions based on various experiments carried out may, however, help the farmer to obtain an insight into the fundamental principles of packing.

Time to Pack.—After the grapes have been allowed to wilt to the desired extent, they may then receive their final trimming to give the necessary attractiveness, looseness, and uniformity to the bunch.

Packing should be in the morning, if possible, not so much because the grapes are then cool, but when grapes are wrapped in paper at this time of the day, the atmosphere between the fruit and the paper will contain less moisture than in the hotter part of the day. When the grapes are then placed in the cool chambers the sudden low temperature will cause less moisture to condense on the fruit.

As regards wrapping grapes, two prevalent methods may be quoted: (*a*) The open pack, and (*b*) the closed pack. It is commonly held that the partition of paper between adjacent bunches keeps infection confined to the affected area and does not allow neighbouring bunches to become infected. It has been shown that fungous infection does not generally take place if the skin of the fruit is sound. Besides, fungus spores occur in abundance within each wrapper, so that any abrasion of the skin will readily become infected with rot organisms. Paper does not, therefore, serve the purpose of confining fungus decay. It is only when grapes become badly decayed that the flow of sap from the collapsing berries to adjacent bunches may be somewhat checked and in such cases paper would have a protecting influence, because the sap will produce points of weakness in the skins of healthy fruit, especially where two berries are in contact, and thus facilitate infection.

Many experiments were carried out to determine the effect of the two methods of packing on the keeping quality of grapes. These tests were made with grapes kept (*a*) at room-temperature and (*b*) at 35° F. The specimens examined at room-temperature were also kept at different humidities to see how far the moisture-content of the air affects the life of the fruit.

To minimize the comparatively large experimental error involved in such types of investigation nearly half a ton of grapes was used.

In the room-temperature experiments the open pack method was found to be somewhat better than the closed pack, but the grapes not wrapped at all kept best. At 35° F. the open pack was also found to be better than the closed pack, though the differences were smaller, and grapes completely wrapped often gave very good results.

The argument is thus far in favour of the open pack, though where thin and porous wrapping papers are employed the closed pack may be as good.

When the atmosphere is moist there is danger that drops of moisture will condense on the fruit and act as points of fungous inoculation. A moderate humidity—60 per cent. for room-temperature and 80-85 per cent. for the cold storage chambers—may be recommended.

In these experiments the effect of handling grapes was also tested. Bunches of grapes were wrapped (*a*) carefully, (*b*) more or

less carelessly, and the wrappers were then removed to eliminate any effects of the wrapping-paper itself. Samples treated as above were compared with fruit not handled in the wrapping process. The handling of grapes markedly reduced the keeping quality, and unless great care was taken in wrapping the product would have had a poor marketing value.

It may be recommended here that, in wrapping grapes, the best procedure would be that at present employed by some of the Constantia farmers. The bunch is placed in the centre of the paper sheet and the paper enveloped around the bunch while the latter remains stationary. The common practice of placing the bunch on one end of the sheet and rolling the bunch until completely wrapped should be avoided.

Type of Wrapping Paper.—As yet only the "Sulphite" wrapping paper imported from Sweden has been tested out. It combines most of the desirable qualities which characterize a good paper for such uses as packing grapes, though it is by no means ideal. The passage of water vapour and CO_2 does not seem to be impeded in any way. All wrapping-paper should have this quality. Accumulation within the wrapper of either moisture or CO_2 acts deleteriously on the fruit.

The paper should, furthermore, be pliable and when folded should not form points sharp enough to cause puncturing or abrasion of the skins. Thin paper is, therefore, preferable, though it should at the same time be strong, especially in an atmosphere of high humidities as often occurs in the sold storage chambers.

TRANSPORT.

Special care should be exercised in off-loading the boxes into trucks. Careful packing of the boxes is necessary to minimize the effects of shunting—movement of trucks and sudden stoppages result in strain and movement of the tiers of boxes in the trucks.

It is recommended that at stations from which large quantities of fruit are shipped, the trucks in which the fruit is loaded be on a separate shunt line, and that no other trucks should run on this line, so that these fruit trucks may be readily hooked on to the train without any further shunting. To cover this line with a roof makes a vast difference to the temperature of the trucks, and a rough shed to protect the trucks from the direct rays of the sun is strongly recommended.

It is important to have the fruit transported from the station to the cold storage during the night. The temperature is comparatively low and subsequent pre-cooling of the fruit is facilitated.

TEMPERATURE OF COOL CHAMBERS.

Rapid pre-cooling of the fruit is very essential, and, wherever possible, direct loading from the trucks into the cool chambers is recommended— provided it is practicable. The 5 per cent. fruit which has to be examined by the Government Fruit Inspector may be kept in the air-lock for examination. Should the consignment be rejected, the boxes will have to be removed from the cool chambers again. It is better to charge up the extra expense of labour thus incurred

to the consignor than to adopt the practice of loading the whole consignment into the air-lock first, where it must await the decision of the Government Fruit Inspector before being placed in the cool chambers.

Should the air-lock, however, be of moderately low temperature, the writer has no objection against this latter practice.

As regards pre-cooling, it seems that this can most effectively be accomplished (*a*) by leaving 6-8-inch spaces between the tiers of boxes in the chambers, (*b*) by allowing a good space between the roof of the room and the top of the tiers, (*c*) by allowing the cool air to circulate through the chambers at a fairly high velocity, (*d*) by not allowing this air as it enters the chamber to go above 32° F.

The air around the fruit and in the box being at high temperature generally contains a comparatively high amount of absolute moisture, though the relative humidity may be low; when this air is thus suddenly cooled, appreciable amounts of moisture may condense. In the pre-cooling process air circulated should, therefore, be of low relative humidity.

Different varieties of fruits should be kept at different temperatures. Citrus fruits, for example, keep best at temperatures around 40° F., whereas pears and apples may be kept with immunity below 32° F. The lower the temperature the more effectively is the decomposing process continuously going on in all fruits retarded and the growth and development of rot organisms inhibited. It is, therefore, in the interest of the producer to have his fruit shipped or stored at as low a temperature as possible. The optimum temperature for grapes has not as yet been accurately determined—36° F. may, however, be recommended.

Wherever possible, the different fruits should not be kept in the same chamber since, as mentioned above, they require different temperatures. Besides, the effect of the aroma of one fruit on the other, though it has not as yet been carefully studied, may be appreciable.

Loading warm fruit into a chamber containing fruit already partially or completely pre-cooled should also be avoided, since the cool fruit will experience a consequent rise in temperature which is highly undesirable.

It has been shown that fluctuating temperatures, as such, stimulate the decomposition of the fruit, which fact should be considered in the transport of fruit, and an attempt made to avoid exposing the fruit to sudden alterations in temperature, e.g. hot, cool, warm, cold, warm, etc. *A continuous lowering of temperature* after the time the fruit leaves the packing-shed of the producer is a good general principle to serve as guide.

Finally it may be stated that fixing the pre-cooling period at a definite duration—a minimum of forty-eight hours according to the Government regulations—needs modification. Since the final temperature reached by the fruit, after a certain time, will depend upon the volume of fruit pre-cooled, temperature of incoming cool air and its velocity, it is only by standardizing these factors that the time required to pre-cool a definite volume of fruit can be determined. A curve may then be constructed which would indicate the time required to lower the temperature of any other known volume

of fruit to a certain temperature. It is the *temperature* of the fruit that should be specified, not the *time of pre-cooling*.

A fairly thorough inspection has been made of the history of the fruit since the time it leaves the packing shed until it reaches the cold storage chambers and is finally loaded into the ship's hold.

Most of the recommendations suggested by investigations carried out thus far has been given in the above paper. Further suggestions in connexion with improvements as regards transport between the Weighbridge and the Harbour Cold Storage, which can be markedly accelerated by the provisions of the necessary facilities, handling of fruit at the Harbour Cold Storage, means of transport between the cold storage and the ship, etc., will be discussed at a later date. Postponement is necessary in view of the vast improvements that will be connected with the new cold storage erected on the East Pier.

Diseases in Sugar-cane: Comments on Mr. H. H. Storey's Investigations.

In *The International Sugar Journal* of September, 1925, reference is made to the great scientific value of Mr. Storey's paper on the Uba Cane Streak Disease in Natal, published by the Department as Science Bulletin No. 39, popular articles on the subject appearing also in the Department's *Journals* for August, 1924, and June, 1925.

The International Sugar Journal remarks that "in reading over the description of the various stages of this successful piece of work, we must remember that the author had no special call to devote himself entirely to disease in the Natal cane-fields. . . . We have read the uphill fight which Mr. Storey had in bringing home to the planters the necessity for early action, and in his patient survey of the Natal conditions he was rewarded by the surprising discovery that the Uba itself had a disease of the same type. . . . There were practically no facilities [in Natal] for research on sugar-cane pests and diseases, and we are justified in remarking that Mr. Storey's progress has been remarkably rapid. . . . Mr. Storey's various published papers on the subject will be widely read by those interested in the study of mosaic diseases in plants, and are a solid contribution to the mass of literature which has accumulated around this subject."

Reference of a similar nature is made also in the *Planter and Sugar Manufacturer* of 29th August, 1925, in which it is stated:—

"This streak disease, as will be seen through following the excellent treatise [of Mr. Storey], appears at least as dangerous and as damaging as mosaic, and it is fortunate that we have now this excellent study of this disease for our observation and guidance in order that our scientists may closely observe the conditions of the cane and see that this disease is controlled if present, and use every precaution to prevent its introduction."

These references to the work of an officer of the Department are most gratifying, and indicate the high standard and far-reaching scientific value of the agricultural research being carried out in the Union.

FERTILIZING POTATOES.

Results of the Bethal Co-operative Experiment.

By THOS. D. HALL, Chemist, School of Agriculture and Experiment Station, Potchefstroom.

NOTWITHSTANDING the unfavourable climatic and economic circumstances that made the 1924-25 season a disastrous one for most potato producers, numbers of farmers have planted, or are about to plant, this crop this season. Although the yields of the past season on the experimental plots were not as good as in the 1923-24 season, the lessons to be learned from the various fertilizer applications are more striking than ever.

A COMPARISON OF THE TWO SEASONS.

	Season 1923 24.	Season 1924-25.	Difference.
Average of the unfertilized plots...	40·9 bags	25·9 bags	15 bags.
Average of complete fertilized plots	97·8 „	72·2 „	26·5 „
Total increase due to fertilizers	56·9 „	46·3 „	
Percentage increase due to fertilizers	139·1	178·7	
Rainfall	26·71 in.	28·55 in.	
Number of days on which rain fell	65	91	--

The climatic conditions were such as to bring about a December development of early blight instead of the usual autumn attack, and as a result, yields were reduced by 25 to 35 per cent. There was also an increase of 82 per cent. in low-grade potatoes, due to the dying off of the vines at a much earlier date.

Fertilizers, however, in many cases increased the amount of No. 1 grades up to 600 per cent. and No. 2 grades up to 300 per cent. as compared with the unfertilized plots of the same year.

Although the actual yields were lower than in the 1923-24 season, the total percentage increase due to fertilizers was far higher. Farmers who used fertilizers would have more of the higher grades, fetching higher prices, and thus lower losses than on the unfertilized lands with their higher number of bags of low grades, which kept a steady and extremely low level all the season. An attempt was made to ascertain what it cost to produce a bag of potatoes and place it on the Johannesburg market, and the figure arrived at was 6s. 4d. per bag from the fertilized plots and 7s. 7d. from the unfertilized plots.

Taking the yield of seventy-five bags per acre with the most economical fertilizer treatment, and calculating the prices for bags of

150 lb. at 7s. 6d. for No. 1 grade, 6s. for No. 2, and 3s. for low grades, the fertilized plots showed a loss of £1. 12s. 4d. per acre; and the unfertilized plots, averaging twenty-six bags per acre, a loss of £3. 8s. 6d. per acre. Slightly better prices would, of course, have given a big profit on the fertilized plots.

THE FERTILIZER REQUIREMENT OF THE SOIL.

Phosphatic Requirements.—On this year's results, 600 lb. per acre of 17 per cent. superphosphate gave £1 per acre better return than the 300-lb. application; and 1,000 lb. per acre, 12s. 4d. better return than 600-lb. It would seem then that in this high-veld area the highest amount of superphosphate might be used, especially if two or three other crops which are unfertilized follow the potatoes in rotation. Where the phosphate was omitted, the nitrogen and potash together gave lower yields than the average of the unfertilized plots.

Nitrogen Requirements.—In the 1923-24 season, ammonium sulphate on the virgin soil was of doubtful value. In the past season, however, there were distinct benefits and a significant lowering of the yield with every 100 lb. decrease of ammonium sulphate. There was 18s. 7d. better return from the 300-lb. dressing over the 100-lb. dressing, and £2. 8s. 4d. better return over the plots with phosphate and potash, but no nitrogen.

Potash Requirements.—There is as yet no indication that potash pays. No increase in yield or improvement in quality has been noted. The most profitable plots on this soil so far have been those without potash. This is a new soil, but farmers on soils that have been cultivated for many years, and for which they have no kraal manure, should, however, try 100 to 150 lb. of sulphate of potash.

GENERAL RECOMMENDATION PER ACRE.

(1) 1,000 lb. superfosphate, 300 lb. sulphate of ammonia, on soils not cultivated for more than two years.
(2) If a liberal dressing of kraal manure is available or a legume green-manure crop has been ploughed under, 600 to 800 lb. superphosphate only.
(3) On well-worked soils without kraal or green manure, 1,000 lb. superphosphate, 300 lb. sulphate of ammonia, 100 to 150 lb. sulphate of potash.
(4) With kraal or green manure: on well used lands, same as No. 2.

All the ammonium sulphate was applied at planting time. It is possible that better results would have been obtained by top dressing half of it after the potatoes were up a few inches, or better results still might be obtained by using nitrate of soda as a top dressing instead of ammonium sulphate.

It is intended to publish all the details of treatments, yields, and costs in this experiment in bulletin form.

THE PROFITABLE PRODUCTION OF STEERS.

Practical Results of Experiments at Potchefstroom.

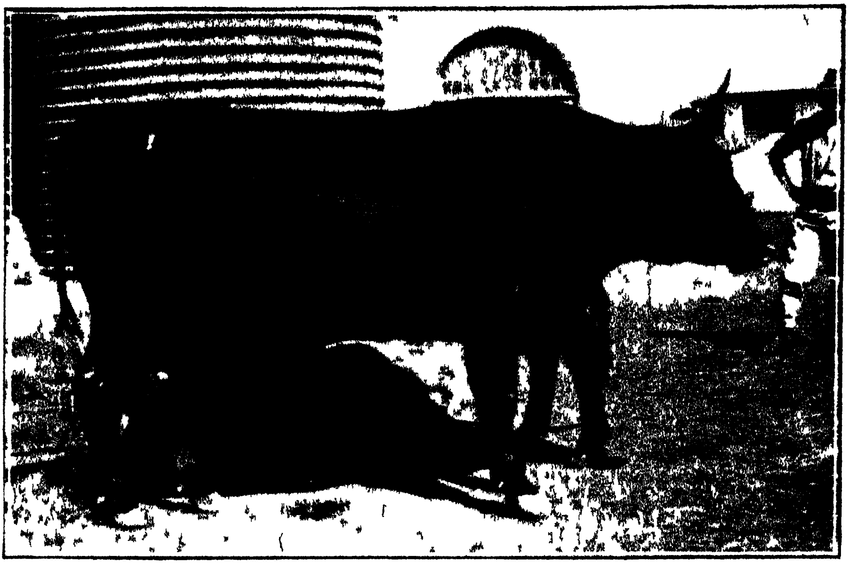
THE results of finishing off steers of our grading experiment herds, once more show what good money could be made on most Transvaal farms from steers of improved breeding under reasonable care, grazing and feeding. The wide gap between emaciated stock in winter months, low-priced slaughter stock at the abattoirs, and huge elevators and bumper crops, is altogether unreasonable and uneconomic. Our farmers must more and more adopt the slogan "Market some of your crops on four hoofs." The elementary principles regarding the profitable production of beef steers are (1) improved breeding stock, especially bulls; (2) reasonable development of weaners and young stock; and (3) ordinary supplementary feeding before marketing.

Recently seven three-year-old steers were forwarded from this Institution to the Johannesburg abattoirs and realized prices varying from £17 to £18. 12s. 6d., when prices at the abattoirs during the winter months—June-October—for "prime" steers varied from £9 to £15. 10s. They were practically veld reared, but received reasonable care as regards dipping, change of pastures, and the use of supplementary feeds, such as silage, hay, and a little grain.

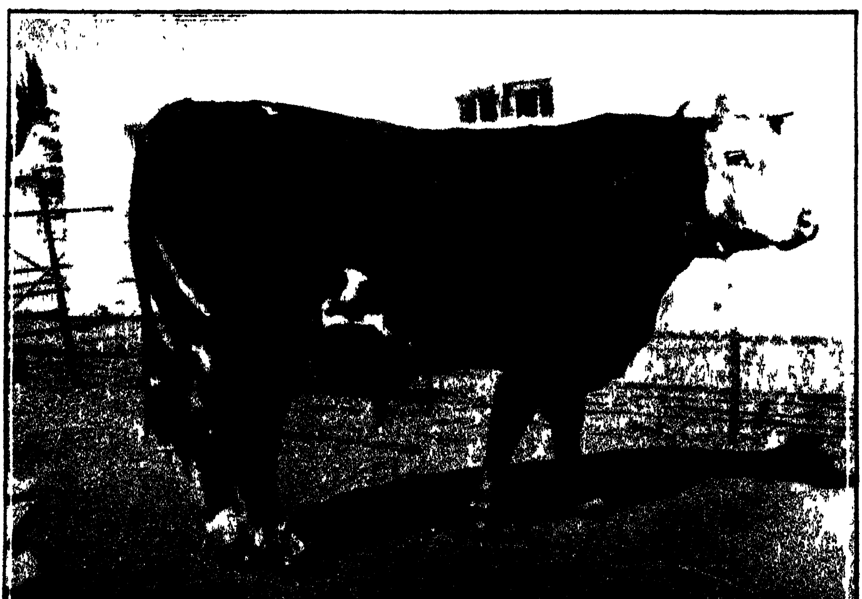
Breeding.—The foundation females were culled Africander cows of good conformation and size; the sires, either pure-bred Herefords or Sussex. The lot consisted of one cross-bred Hereford (H.A.), four Hereford grades (HH.A. and HHH.A.), and one grade Sussex (SS.A.), and one culled Sussex (S).

Treatment.—As weaners they received a little silage and hay, for about 95 days. As two-year-olds they received no additional feeding, but a change of pastures. At the end of their second summer (May) they were brought to the home farm and grazed on maize stalks, later supplemented by silage, beginning with 10 lb. and increased up to 40 lb. This feeding just about maintained their good summer condition. Later the silage was supplemented by maize-meal and some good veld-hay. For 55 days they received maize-meal from 5 lb. increasing to 9 lb. per day, at the latter part of the period. Very good gains of over 2 lb. per day were made during this period, with individual gains of over 3 lb. per day.

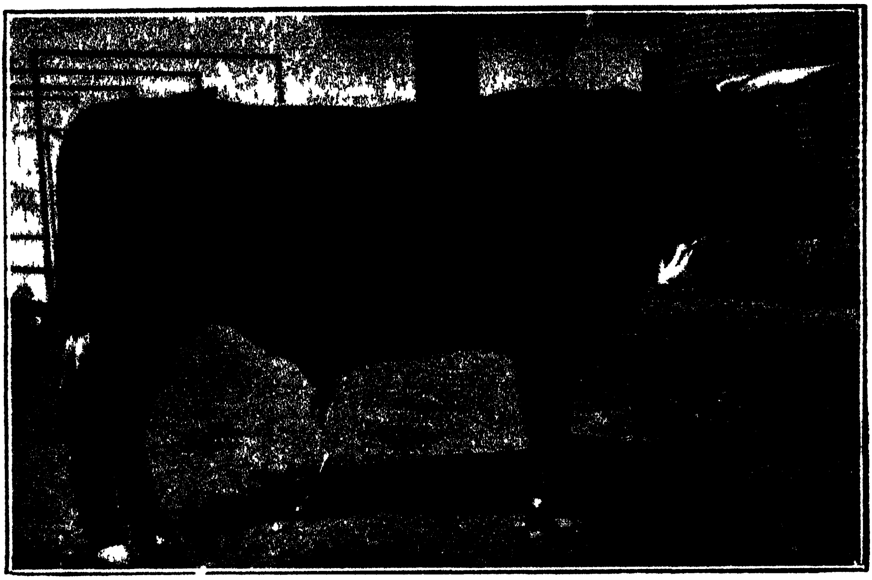
Maintaining summer conditions well through the winter was both successful and profitable, as the total cost of artificial feeds only amounted to £2. 11s. 10d. per steer.



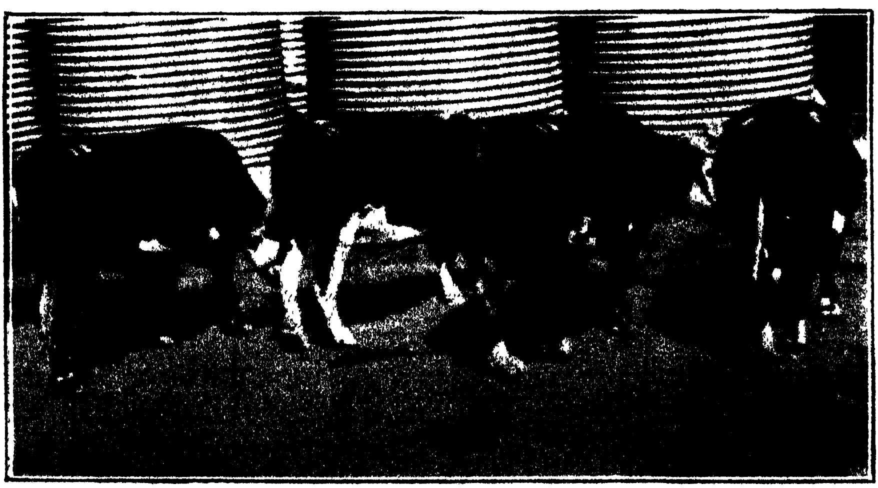
A prime three-year-old Sussex-Africander grade, final weight 1,460 lb., £18. 12s. 6d.



A prime three-year-old Hereford-Africander grade, final weight 1,483 lb., £17. 12s. 6d.



"Blood tells"—A culled Sussex steer that made the highest gains—254 lb.—during the period of supplementary feeding.



Well-filled twists, thighs, and loins—the signs of a profitable steer.

The following table of weights shows the development of the steers at different ages:—

Breed.	Age, Months.	Yearlings. 25th Oct., 1923.	Two-year-olds, 10th Oct., 1924.	In June: 6th June, 1925.	Final Weight. 13th Oct., 1925.	Total Gain from June.	Dressed Weight.	Price Obtained.
SS.A ...	37	540	980	1,325	1,460	135	835	£18 12 6
HH.A ...	36	575	875	1,265	1,433	168	770	17 12 6
HH.A ...	35	580	880	1,240	1,382	142	760	17 12 6
HH.A ...	35	505	740	1,165	1,370	205	760	17 12 6
H.A ...	35	440	860	1,075	1,225	150	680	17 12 6
HHH.A	34	400	710	1,150	1,355	205	740	17 0 0
S. ...	36	—	—	1,070	1,324	254	700	17 0 0

The gain per day for the period when maize-meal was fed was, as stated before, well over two pounds per day. The above gains were made during a period (June-October) when cattle on the veld, in practically all parts of the Transvaal, either lose heavily in condition, or in the favoured spots barely maintain their summer condition.

Up to the present, observation and deduction from results of experiments have shown that the reasonably good treatment the weaners receive during their first winter and early summer, is responsible for more than half of the good results obtained at the age of three. The prime three-year-old steer can be produced with profit, provided he possesses the breeding to respond to reasonably good treatment.

The market report on the live steers and their carcasses was glowing. They were declared prime, and fit in every way for export to the London market, by the abattoir authorities and the master butchers, who expressed the wish to see their kind more often on the Johannesburg market. This is an achievement well within the reach of practically every Transvaal farmer.—(*Potchefstroom School of Agriculture.*)

Nurseries in Quarantine at the 1st December, 1925.

Name.	Address.	Cause of Quarantine.	Extent of Quarantine.
Distributors Co., Craighall Nursery	Craighall, Johannesburg	Crown-gall and Root-gall Worm.	Deciduous, all.
D. J. Conradie & Bros.	Robertson, C.P. ...	Red Scale ...	Citrus, all.
A. S. Strydom & Co. ...	Krakeel River ...	Woolly Aphis ...	Deciduous, part.
G. J. Labuschagne ...	Groot Marico ...	Red Scale ...	Citrus, all.
Distributors Co., Craighall Nursery	Craighall, Johannesburg	Pernicious Scale...	Deciduous, part.
C. A. Geerdts	Lydenburg ...	Pernicious Scale...	Deciduous, all.

RAISIN-MAKING.

Progress Report on Farmers' Co-operative Experiments, 1925.

By L. PERKINS, Dried Fruit Officer, Elsenburg School of Agriculture.

IN order to stimulate interest in the improved production of dried fruits generally, with particular reference to raisins and sultanas, and in view of the urgent need of experimental data on the subject, certain experiments were carried out during the season 1924-25, not only for the purpose stated, but that the results also might be used as object lessons for the future guidance of farmers.

To obtain material properly representative of the raisin-making area, the Worcester District was taken. This, in turn, was divided in four sub-sections, each being represented by one farm. This not only introduced differing conditions, but also provided bases from which to work among the different communities. It was intended to hold practical demonstrations on these properties after the experiments were finished, in order to demonstrate to farmers the advantages and disadvantages of certain operations. Unfortunately, owing to pressure of grape investigational work at Paarl, this was impossible. The experiments, however, were completed. The farms belonging to the gentlemen named hereunder were chosen:—

1. J. Theron, Mimosa, Doornrivier.
2. P. van der Merwe, Boontjiesrivier, Goudini.
3. J. C. Rabie (Dirk's son), Brakvlei, Nuy.
4. Wilhelm Naude, Overhex.

These farms are well situated and afforded excellent facilities for good work. All told, 175 samples were obtained from the four farms, representing different methods of treatment, such as sulphuring, dipping, stacking, and turning.

On the properties of Messrs. Theron and Rabie sultanas only were handled, while on those of Messrs. Van der Merwe and Naude, hanepoot only.

The following is a résumé of the results obtained:—

Stage and Signs of Maturity.

For some years a doubt seems to have existed with regard to the stage at which grapes should be harvested. The experiments showed undoubtedly that sultanas should be well ripened and of a golden yellow colour. The green-coloured bunches produce bright red or dark products, and not the requisite golden yellow in the case of the bleached and the bright amber in the case of the unbleached.

There are three different ways by which the ripeness of the grape can be tested: Saccharometer, taste, and colour. The saccharometer is an instrument too well known to need description. To properly test the grapes, a few bunches should be picked from several vines, the juice squeezed out and passed through muslin or otherwise strained. The must is then poured out into the test-tube and the saccharometer inserted. If it shows 25 degrees or more of sugar, the grapes will make good raisins, provided that the great proportion are still crisp and not shrivelled. It is the shrivelled, dried-up berries which do not crack upon dipping that are the cause of so many of our low grade products. Only inexperienced vineyardists will require the aid of the saccharometer to determine the state of ripening of the grapes, the more experienced judge by taste and colour.

The taste is the most commonly used method for ascertaining the ripeness of the raisin grapes. Every grower, whether experienced or not, should examine his grapes repeatedly. To give directions for tasting the ripeness of the grapes is, of course, impossible; it must be learned, and can only be learned by practice. It is enough to say here that the grapes should taste very sweet, contain no acid, and, if possible, be rather solid.

The colour is also a valuable guide in determining the ripeness of raisin grapes. Fully ripe and perfect fruit should be amber yellow, somewhat transparent, and waxy. If this colour is combined with great sweetness, and in hanepoot, with absence of acidity, we can be sure that the grapes are ripe. Some grapes do, however, acquire the yellow amber tint without being sweet, especially when too much exposed to the sun, but they are readily distinguished from the ripe grapes by their being of smaller size and harder, tasteless, and acid. Such grapes never develop into good mature grapes, and do not make good raisins, nor do all ripe grapes become amber coloured. Those that grow in the shade often remain green in colour although they acquire a certain sweetness, and will make good raisins. They should, however not be harvested with the first picking. In order to make a superior raisin, all grapes should be "dead" ripe, especially so if the grapes are to be dipped in lye. If unripe or partially ripe grapes of hanepoot and sultanas are dipped, they make very poor red-coloured raisins. It would be better if they were left until riper. This is especially the case with the sultana, which begins to ripen and is eatable long before the hanepoot, but which only makes a good dipped raisin after the hanepoot has been ripe for some time. Three or four days make a great difference sometimes in the amount of sugar in the grapes, and consequently in the quality of the raisin, and the experienced grower will keep his grapes on the vines as long as possible in order to obtain the greatest possible amount of sweetness, providing the grapes are not endangered by fungous diseases, moulds, and climatic conditions.

The fruit was examined after storage of five months, and the following results were obtained from the hanepoot experiments:—

Experiment 1: To Determine Strength of Lye.

The question is frequently asked: "How strong should the dipping lye be?" Such a great number of factors influence such a decision that as many as possible were eliminated. Throughout this

experiment grapes of the same approximate ripeness were used. These were harvested at the same time, and underwent similar treatment right through the test. Different concentrations of dipping solution were used, varying from 1 lb. of lye to 10 gallons of water to 1 lb. of lye to 40 gallons of water. The fact that grapes grown in one area are very different from those grown in another was also taken into consideration, and separate reports were made to suit particular districts.

When comparing samples dipped in 1:10 with those of 1:40, there was certainly a very marked difference. The first-mentioned lots granulated considerably upon storage. This was caused no doubt by dipping in too strong a solution. The weaker solution was by far the best solution. The samples dipped in 1:20, 1:25, 1:30, 1:35, etc., showed a gradual ascending scale of improvement. The samples dipped in 1:40 are still in good general condition, and do not show granulation. General recommendations for solutions to be used in different areas will be made later. The fruits dipped in the stronger solution not only showed granulation but had a sticky appearance. Although not much difference could be seen regarding the colour, there is no doubt that the weaker solution gave the best results.

Duplicate quantities of dipped fruit were made. The one lot of samples was washed while the others were placed directly on the trays. After a period of storage the washed samples are infinitely better than the unwashed, and they have a much cleaner appearance. In the earlier stages the difference was not so well marked. The cracking of the berry should be hardly discernible to the eye.

In so far as the experiments indicate this year, the following tentative recommendations can be made as to lye concentrations in the various areas:—

Doornrivier P. v. d. Merwe	1 lb. of lye to 35 gallons of water.
Brakvlei Overhex	1 lb. of lye to 30 gallons of water.

In this experiment the sugaring is not so evident just after drying, but after storage it soon makes itself evident.

Experiment 2: To Determine Length of Dip.

One of the greatest factors in the production of a low grade raisin is the parboiling of the fruit at dipping by holding the fruit in the boiling solution for too long a period. To test this out, different samples of fruit were subjected to various lengths of dipping, and the fact remains that the shorter the time of dipping the better. Only sufficient time should be given to completely submerge the berries. Another point of importance is that a short dip produces a more fleshy berry. Overdipping causes berries to granulate to a marked extent upon storage. Two or three seconds are certainly the best time for dipping. The length of time required for dipping can only be ascertained by experience, and must differ with the strength of the lye, with the heat of the solution, and with the thickness of the skin of the grapes. Thus, in different localities, the strength of lye must always be different, but the length of immersion should be as short as possible. When properly dipped, the skin of the grapes

must show some very minute cracks, similar to cracks in glass which has been heated and suddenly immersed in or sprinkled with ice-cold water. Deep cracks are not desirable, as they will cause the juice of the pulp to leak out, after which the raisins will sugar.

A very short dip is recommended. Only sufficient time should be given for the complete immersion of the berries.

Experiment 3: To Determine Period of Sulphuring.

The present recommendation to be followed out by farmers is the use of 2 lb. of sulphur per 100 cubic feet for 5 hours. The analysed results were as follows:—

No. (20) .041 SO_2.
No. (34) .048 SO_2.
No. (44) .071 SO_2.

These samples were tested for SO_2 content in order to see how they compared with the new regulation of the British Board of Health, which states that no fruit imported into Britain shall contain more than .1 per cent. SO_2.

Experiment 4: To Determine Weight lost due to Sulphuring.

As far as can be seen no difference in weight is experienced whether sulphuring or no sulphuring is practised.

Experiment 5: To Determine Weight lost due to Green Grapes.

In this experiment there was a loss of weight in every case when using green grapes.

This points to the factor of harvesting uniformly ripe fruit. Green bunches mean loss of weight to the farmer.

Experiment 6: To Determine Effect of Turning.

After the grapes have been exposed to the sun for some time they must be turned. By this time it will be found that the grapes have dried, principally on the upper side, while the lower side is yet comparatively green. The time when the turning of the grapes should be done depends to a great extent on the weather. Approximately half of the drying process should be over, and this requires a longer or shorter time according to conditions. When the time for turning is at hand, it will be found that the under side of the grapes, or rather the side of the berry that was placed against the trays, has flattened out and shows concentric circles, which are considered of much beauty and greatly valued in all good raisins. When they are well formed and established, it is generally time to turn. If the grapes are turned before these concentric circles have hardened, the latter will open and become less distinct. Another objection to turning too early is that the upper side of the grapes if not properly dried before turning will dry very slowly afterwards, and often so slowly that the raisins will have to be turned a second time, which will prove both expensive and to the disadvantage of the raisins. If properly hardened and watched, one turning is always sufficient.

Turning should, as much as possible, be done in the forenoon after the sun has been up for a short while, while the air is yet cool and the stems of the raisins damp. The turning of the fruit will not then cause the stems to break off and the quality of the raisins to be impaired.

According to the experiments, it is shown that should the drying period take about seven days the raisins should be turned on the third. Fruit thus treated showed a better colour than fruit turned earlier and later.

Experiment 7 : To Determine the Effect of Stacking.

Ordinarily, stacking is looked upon as a means of protection from dew, cold, and rain, particularly late in the season, when it takes several hours of sunlight to dry the night dews. However, this experiment was carried out principally to test its effect upon the general quality and colour of the resulting product. The first picking should be placed pretty close on the trays, not allowing any part of the tray to be visible, as the reflected heat will be too great and may injure the raisins. The second picking should be packed less close, as the reflected heat from the surface of the tray will help to dry the grapes. This, of course, only refers to localities where the temperature during the first drying is very high. The warmer it is the closer should the bunches be packed on the trays, and, on the contrary, when later on in the season, or when the drying weather is unfavourable, plenty of space should be given the grapes. It is often said that grapes, to make good raisins, should not only dry but cure; and this is where the importance of stacking the trays comes in. There is much truth in this. Good raisins should dry and cure at the same time, by which is meant that a chemical process is taking place, which is something more than the mere evaporation of water in the grape. The heat necessary and favourable for drying the grapes is different in different localities. At certain temperatures the raisins will become cooked and spoil, assume a red colour, lose their sweetness, become sour and hard, leathery and tough, and covered with large, sharply defined corrugations—signs of a very inferior or even entirely worthless raisin. A temperature of from 90° to 103° in the shade would be the best temperatures for drying perfectly ripe and sweet hanepoot grapes. When grapes are very ripe a fairly high temperature will not injure them, while unripe and sour grapes will burn or cook at a lower temperature than would be the proper one for ripe grapes. A good, warm day tempered with a fair breeze is really the ideal condition. In order therefore to imitate these conditions as far as possible, it is advisable to stack the trays for a period during the drying. Experiment 7 has proved very interesting in that it appears that fruit stacked throughout its drying period produced a very fine light coloured product with fine flavour and texture and a nice pliable skin. A sample which only received one day of stacking showed several hard sunburnt berries, with a general appearance of very dark red colour and skins tough and leathery. An interesting point to be proved next year is whether it is better to stack in the beginning or at the end of the drying period. By stacking in the beginning for a couple of days the time of drying will in all probability be reduced.

It appears from the experiments already carried out this year that more weight is obtained by stacking the third day out. After that the fruit loses in weight instead of gaining. It can be easily understood that the dipping exposes the tissue to the direct rays of the sun, and because of the oxidation darkening soon takes place. As much protection as possible should be given. Stack the trays so that the prevailing winds can blow through the trays removing as much moisture as possible.

The present recommendation is for farmers to stack the fruit for as long a period as possible compatible with the rate of drying.

[Our thanks are due to those farmers who so willingly co-operated in this work, without which these experiments could not have been carried out.

Reference: "The Raisin Industry," by Eisen.]

Control of Field Mice.

The formula for poisoned grain is as follows:—Strychnine sulphate or strychnine hydrochloride, 1 ounce; boiling water, 2 quarts; laundry starch, 2 tablespoonfuls; cold water, ½ pint; wheat or oats (clean grain), 1 bushel.

Dissolve the strychnine in the boiling water. Dissolve the starch in cold water. Add the starch to the strychnine solution and boil a few minutes until the starch is clear. Pour the solution over the grain in a tub and stir thoroughly until each grain is evenly coated. Let the grain stand over-night to absorb the poison.

The poisoned grain should be distributed along the runs and near the holes, not more than a teaspoonful in a place. Choose areas covered with weeds, grass, bush, straw, or rubbish on which to scatter baits so as to avoid destroying birds. Remember that strychnine is very poisonous to other animals. (*Elsenburg School of Agriculture.*)

SCALY BARK (*PSOROSIS*) OF CITRUS TREES.

By E. M. DOIDGE, M.A., D.Sc., F.L.S., Assistant Chief, Division of Botany and Plant Pathology.

SCALY Bark, or *Psorosis*, is one of the most serious bark diseases to which citrus trees are subject, and one which may cause considerable loss to South African growers if it is not promptly dealt with.

SYMPTOMS.

The first indication that a tree is infected with scaly bark is a cracking and raising of the bark on one or more small areas, usually on the trunk or one of the larger limbs. These are at first not more than half an inch to one inch in diameter, and are so small and inconspicuous that they would be overlooked by the average growers. At this stage, only the outer layer of bark appears to be injured, the inner layer next the cambium being still alive and active and free from discoloration, except that it frequently presents a slightly greenish appearance.

The affected area spreads gradually, the progress of the disease being marked by the appearance of irregular scales of bark one quarter to one inch in diameter, which stand out as if they were being pushed up from the surface. At first, only the outer bark dies, and this hardens and scales off, leaving an inner layer of bark still alive. From the latter, new bark is often formed within the affected area, and this is much thickened, rough, and yellowish brown, and often shows a slight exudation of gum; this gives the affected limb a roughened and altogether unwholesome appearance (Fig. 1).

The most rapid progress of the disease is up and down the affected limb, but it also extends laterally until it finally encircles the trunk or limb, and when it is more than usually active long strips of bark sometimes become slit and curl outwards (Fig. 2). Later the deeper layers of bark, and even the wood, may become affected and discoloured. There is often some exudation of gum as the disease advances, but this is not an essential symptom of the disease, and its presence and amount depend on growth and seasonal conditions.

Naturally, when the larger limbs and the trunk are extensively affected, the trees are stunted and reduced to an extremely poor condition, and some of the limbs may be killed outright. Such trees are not only useless and unprofitable, but are a constant source of danger to neighbouring trees which are apparently sound.

CAUSE.

To explain the last statement it must be stated that although the actual cause of scaly bark is not yet known, in spite of many

years of investigation, certain facts have been established by Dr. Fawcett (1) in his work at the Citrus Experiment Station, Riverside, California. In certain cases it has been possible to transmit the disease to sound trees by inoculations with bits of tissue from diseased lesions, although many attempts have failed. This experiment I have repeated with diseased bark from the northern Transvaal, and

Fig. 1.

have been successful in producing the early stages of the disease on one Washington Navel tree.

In one successful case, in Dr. Fawcett's experiments, two years elapsed after the diseased tissue was placed in a wound in sound bark before any sign of disease was noticed. This suggests that an organism of some kind which is able to advance very slowly may be the immediate cause of the disease. On account of the slowness with

which the disease often develops, any investigation into its cause and nature must of necessity be slow in yielding results, and it will probably be some years before any precise information is available. But this much has been established—that scaly bark is a communicable disease, and that the presence in an orchard of trees with large untreated lesions will almost surely lead to a great increase in the number of affected, and consequently unprofitable, trees.

TREATMENT EMPLOYED IN CALIFORNIA.

In California, a measure of success has been achieved in treating the disease, particularly when it has been detected at an early stage. The following is the method recommended by Dr. Fawcett:—

First Stage.—When the affected areas are small and do not cover more than one quarter of the circumference of the limb, and while the injury is still superficial, the affected bark may be scraped rather deeply and the surrounding apparently unaffected bark scraped lightly from four to six inches in all directions beyond the margin of the affected areas. The wound is then painted over with a disinfectant.

Second Stage.—When the disease has progressed further so as to cover more than one third of the circumference of the entire bark on the trunk or limb, but has not yet seriously injured the wood, it may, for convenience, be considered to be in the second stage. At this stage the affected portion often presents a roughened surface. Fresh scaling of the bark on the advancing edges continues, and exudation of gum takes place at certain seasons of the year.

In such cases the cure is more uncertain, but the disease may often be checked by a light to medium scraping. Particular attention should be given to the advancing edges, and care must be taken not to scrape so deep as to kill the inner layer of bark. The affected surface may then be covered with a disinfectant. Six months or a year later the treatment should be repeated.

Third Stage.—Where the disease has been present for a number of years, particularly when the greater part of the bark of the trunk is affected, there is little hope of permanent recovery. If only a part of the branches shows the disease, such may be cut out entirely and the remainder of the tree frequently inspected for further outbreaks. If the trunk is badly decayed and the entire tree appears stunted and unproductive, the tree should be dug out at once.

The kind of fungicide used for painting the wounds appears to be of minor importance, the scraping being the essential part of the treatment. Either bordeaux paste or carbolineum may be used; the latter having some value in preventing the invasion of damaged tissues by termites.

HISTORY OF THE DISEASE.

In America, this disease was briefly described in 1896 by Swingle and Webber in Florida, who gave it the name of *Psorosis*: the name scaly bark is in more general use, but the name *Psorosis* should be retained, as it serves to distinguish it from the Florida scaly bark or nail-head rust, which is an entirely different disease caused by a known organism, *Cladosporium herbarum* var. *citricolum*.

Scaly bark has been known in California and has been under investigation for a number of years, but although it is widespread and causes considerable loss, the specific cause has not yet been discovered, and no really satisfactory treatment has yet been devised.

In South Africa, scaly bark was first reported from the northern Transvaal in December, 1918, on nine-year-old Washington navel trees which were in bearing. The grower, who sent specimens for examination, described the apparence of the trees as follows:—

"The branches of the affected trees have the appearance of what I know to be apple canker. The outer bark of the trees is stripping at the junction of the main branches with the main stem, also on the main branches in the centre of the tree. Trees affected are sickly in appearance, foliage yellow, and fruit very rough in appearance. Number of trees affected, about twenty."

In this orchard it was estimated in January, 1925, that about 75 per cent. of the trees were affected by scaly bark.

In 1920 the disease was detected on two farms which were being thoroughly inspected on account of citrus canker, and by 1922 it was known to occur on two farms in the Marico District, two in the Rustenburg District, and two in the Pretoria District. Trees noted at this time were all six to twelve years old. Various additional cases of infection were reported from time to time, chiefly by the citrus canker inspectors. This is no indication that scaly bark is more prevalent in the areas quarantined on account of citrus canker than in other parts of the Union, but it was more likely to be detected in these districts on account of the frequent and thorough inspection of the orchards.

In July, 1925, Mr. Hobson was detailed to ascertain definitely the extent of scaly-bark infection so that an estimate might be formed of the number of trees involved. Unfortunately, he was unable to cover more than the Magaliesberg area in the Pretoria and Rustenburg Districts, as his services were urgently required at Capetown in connexion with the export of citrus fruit.

The results of the inspection may be summarized as follows:—

	Number of trees infected with Scaly Bark.	Total number of trees in orchards inspected.
Rustenburg District	276	88,000 approximately.
Pretoria District	36	2,675 approximately.

In addition, scaly bark is known to occur in the Warmbaths area (on naartje trees) and in the Marico District. In the eastern part of the Cape Province two trees affected with scaly bark have been seen in the neighbourhood of Grahamstown. It is proposed as soon as possible to complete a detailed survey of the citrus orchards of the Union, and it is to be anticipated that cases of infection will be found in many localities.

Scaly bark is also known to occur at Gwelo in Rhodesia.

In certain orchards which have been under observation for a number of years, figures are available which show that the disease is seriously on the increase. To quote two instances: in an orchard where nine trees showed scaly bark in 1921, 73 are now affected; in another orchard, four trees were diseased in 1922, and forty-six trees in 1925. In some orchards the disease appears more virulent than in others, and within the last few years many trees have been reduced

to a decidedly poor condition. There is some evidence that scaly bark progresses more rapidly in South Africa than is reported to be the case in California; but this requires to be confirmed by further observation.

ERADICATION RECOMMENDED.

At present the number of trees affected with scaly bark represents a very small percentage of the trees in the orchards concerned.

FIG. 2.

Treatment has been attempted in some cases along the lines recommended in California, but has met with small success. This may be attributed to three causes:—

(1) The fact that scaly bark is not easily detected in the early stages, when it is amenable to treatment. It is usually not observed until the tree is too seriously injured to recover after treatment.

(2) The scraping, which is the essential part of the treatment, is not carried out with sufficient care and thoroughness.

(3) In certain cases the affected areas seem to have spread with unexpected rapidity. In one case it was reported that an area on the limb was treated, and that on examination *three months* later, it was found that scaly bark reappeared and had extended up the branch to a distance of three to four feet. It must be admitted, however, that observations of this kind are in need of confirmation.

It would appear that the only effective way of preventing the spread of the disease would be to uproot and destroy all affected trees or parts of trees. Sometimes only one limb is diseased, in such a way that it can be cut off well below the point of infection, but most frequently the infection involves the main trunk, and it can only be effectively dealt with by destroying the whole tree. In view of the small number of trees at present involved, this policy will be practicable if it is put into execution without delay. It has been definitely proved that scaly bark is an infectious disease, and in one orchard under observation it definitely spread from infected trees to others standing along the same irrigation furrow in the direction of the flow of the water. Every tree affected with scaly bark left standing in the orchard, particularly when showing large untreated lesions, is a constant source of danger to neighbouring trees which are still apparently sound. Growers often hesitate to remove affected trees because one or two branches not yet diseased continue to bear well. It is hardly necessary to point out that this is a very short-sighted policy.

Dr. Webber, in his report (2), has strongly advocated the policy of eradication in connexion with scaly bark. In this connexion he writes:—

> "The writer has been much interested in this disease and has searched for it in practically every grove visited. He has also in all cases inquired of grove owners regarding the disease, and he thinks, therefore, that he has seen most of the cases that exist in the groves visited. Typical cases of the disease were found at Bulawayo, Mazoe, and Gwelo, in Rhodesia, but never more than one or two trees in a grove. In the Union, one grove at Louis Trichardt and one at Groot Marico were found to be rather badly infected. In all other places, only an occasional diseased tree could be found. No cases were observed in the Nelspruit-Barberton area or in Natal, and only a single tree showing typical lesions was seen in the eastern Cape Province, near Bathurst. Several cases were observed in groves in the Rustenburg section, but in no grove visited were there more than a very few diseased trees.
>
> "It is probable that many cases existed in the regions visited that were not seen; but rather extended inquiries were made, and the few cases found demonstrate very clearly that the disease has not become very widespread as yet. In all cases found, the advice given was to dig up and burn the trees, root and branch, rather than attempt treatment. It was felt that the most satisfactory method of control in cases where so little of the disease exists, is to prevent its spread by prompt eradication.
>
> "Considering the situation in retrospect after examinations all over South Africa, I would earnestly recommend that a policy

of eradication be adopted in the control of this disease both in the Union and in Rhodesia. The disease is so easily recognized and located by inspection and the monetary loss so small in putting such a policy into effect, that citrus growers generally will be in favour of such a policy and anxious to co-operate with the Government in putting it into effect. This seems to the writer under the conditions the best method of control, and if carefully followed up, might result in totally eradicating the disease from the country. In any case, whether eradication is achieved or not, it is in the long run probably the cheapest method of control in view of the present rareness of the disease."

Free reference has been made to the following publications:–

(1) Fawcett, H. S., "Gum Diseases of Citrus Trees in California," University of California Agricultural Experiment Station Bulletin No. 360, 1923.

(2) Webber, H. J., "A Comparative Study of the Citrus Industry of South Africa," Union of South Africa Department of Agriculture Bulletin No. 6, 1925.

Outbreaks of Animal Diseases: November, 1925.

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Total for Nov., 1925.	Total for Calendar Year. 1924.
East Coast Fever	1	3	—	—	—	4	125
Mange	3	16	9	2	8	38	455
Anthrax	14	7	7	3	23	54	1,494
Dourine	—	—	1	—	—	1	14
Glanders	—	—	1	—	—	1	56
Tuberculosis	—	—	4	—	—	4	18
Epizootic Lymphangitis	—	—	—	—	—	—	2

AGRICULTURAL ECONOMIC CONDITIONS IN SOUTH AFRICA.

By F. E. GELDENHUYS, Chief, Division of Agricultural Economics and Markets.

ECONOMIC FACTORS IN FARMING.

FARMING is a business proposition, and unless conducted on sound business principles, it cannot be productive of much success or gain.

Efficient and profitable production in farming depends upon the following factors, viz.: Nature, labour, capital, and managerial ability in organization of farming operations and sale of products. These factors determine the quantity and quality of the yield and profits. Profits are limited and reduced if natural conditions are unfavourable, if labour is scarce and inefficient, if capital is insufficient, and managerial ability poor.

Nature.—Deficiencies in the natural factor may be poor climatic conditions, an uneven rugged surface, inadequate space or extent of land, infertile soil, and other such factors.

Labour.—The efficiency of labour is determined by its quality and manner of application.

Capital.—Too little capital makes production impossible, restrains further endeavour, and limits profits. The more efficient the outlay of capital the greater the profits.

Managerial Ability.—Knowledge and ability to apply it are essential to good management. High managerial ability would increase the productive capacity of nature, labour, and capital, and would make the marketing of produce advantageous to both consumer and producer.

The farmer's profits are, therefore, amongst other things, determined by his locality, the extent and nature of his soil, the quantity and quality of his products, the quantity and character of his labour, capital and business ability, as also by the efficiency of organization in his activity and amongst members of the farming community.

ECONOMIC CONDITIONS OF FARMING.

The extent and importance of farming as a business is apparent from the following statistics:—

Population (European) of the Union.

	1917-18.	1921.
Rural	654,932 (46.05 %)	671,980 (44.59 %)
Urban	766,849 (53.95 %)	847,508 (55.41 %)

Farm Labour, Male 1917-18 (1921 *not available*).

	European.	Native.	Coloured.
Cape Province	23,615	70,933	37,352
Transvaal	7,863	69,968	960
Orange Free State	7,993	59,638	1,249
Natal	2,281	54,084	18,439*
Union	41,756	254,623	58,300†

The Number of Farmers in the Union.—According to the population census of 1921, there are in the Union 163,830 European males of fifteen years and upwards who are engaged in agriculture. This is out of a total male European population of 782,035 (of which 320,939 are dependents, children, etc.), and constitutes by far the greatest section of the population.

This means that of every 1,000 European males in the Union, 410 are children and 210 are males of fifteen years of age and over engaged in the primary industry of agriculture. The next on the list is the industrial worker with 119, and then commerce with 102. Transport and communication (railways, etc.), accounts for 40 and mining for 26. The professions are divided into two sections, of which administrative government shows 29 and other professions 21. In every 1,000 there are 13 of independent means.

When the number of farmers gainfully occupied (that is, actually working for a monetary return) is compared with European males similarly occupied in other directions, it is found that out of every 1,000 males there are as many as 374 farmers, industry being next with 212, then commerce with 182, transport and communication with 71, and mining with 46; administrative government accounts for 52 and other professions 38. Here we find, also, that the males gainfully occupied in the Cape Province, Transvaal, and Orange Free State are preponderatingly farmers, but that in Natal farmers are only third on the list, industrial workers being first and commercial second.

The Orange Free State provides employment on farms for 8,000 Europeans and 60,000 natives; the Transvaal for 8,000 Europeans and 70,000 natives. The Orange Free State, therefore, with an acreage of 8,000,000 morgen less, compares very favourably with the Transvaal.

The number of European labourers, however, is largest in the Cape, where it stands at 24,000, as against 71,000 natives and 37,000 non-Europeans. If we consider that the Cape is four to four and a half times larger than the two northern Provinces, then we must conclude that they compare very favourably with the Cape.

That agriculture is still South Africa's premier industry is apparent, not only from an examination of census returns, but also upon analysis of the employment it provides and revenue it produces.

For 1917-18, participants *in agriculture* (farmers excluded) were: 42,000 European labourers and 313,000 non-Europeans; total 335,000.

In the Mines: 33,500 European labourers and 268,000 non-Europeans; total 302,000.

In Industries: 44,000 Europeans and 77,500 non-Europeans; total 122,000.

* Of this number, 18,405 are Asiatics. † Of this number, 19,627 are Asiatics.

In other words, agriculture, compared with either mining or manufactures, provides employment for a greater number of people—one-sixth more than mines and thrice as many as manufactures. It may be assumed that agriculture, as an industry, is paramount in the Orange Free State; for her mineral output for 1921 was only about one-tenth, and for 1922 one-twentieth, of her agricultural production, while the industrial yield for 1921 is only about one-fifth, and for 1922 28-100th that of agriculture. In Transvaal, on the other hand, the mines produce three and a half times as much as agriculture, and industries about 16 per cent. more; for 1922, the figures were respectively twice as much and half as much. The Transvaal, therefore—and that chiefly in its towns and cities—more especially Johannesburg and its neighbourhood, will be able to provide its population with a source of income. If next we investigate the industrial income of the Cape Province and Natal, and see its importance there, we find that the Orange Free State is the principal agricultural Province. The following figures confirm this:—

Area and Value, 1921—Excluding Native Locations and Reserves.

Province.	Area of Farms.	Value of Products.		
	Morgen.	Agriculture.	Mines.	Industries.
Cape	64,291,000	£24,000,000	£1,500,000	£12,500,000
Transvaal ...	21,945,000	13,000,000	47,000,000	15,000,000
Orange Free State	14,274,000	10,000,000	1,000,000	2,000,000
Natal	4,767,000	9,000,000	3,000,000	7,500,000
Total for Union...	105,277,000	£56,000,000	£53,000,000	£37,000,000

While these figures show that agriculture is most intensive in Natal, they also indicate that the Orange Free State, more than the three other Provinces, has chiefly to rely on agriculture for her prosperity.

How favourably the Orange Free State compares with the other Provinces in this respect is also evident from income tax returns. For 1921-22, the taxable income from agricultural sources was for the Union, £2,056,807; Cape, £746,377; Natal, £339,050; Transvaal, £225,279; Orange Free State, £697,895. For 1922-23: £2,746,939; £1,373,886; £332,260; £613,622; £1,348,193 respectively.

The Orange Free State, therefore, whose total income from agricultural sources is considerably less than that of the Cape, stands on an equal footing with the latter as far as provincial contributions, in the form of revenue, are concerned, and is a good way ahead of the Transvaal. The position in the latter Province, judged by income tax returns, is not too favourable. Her taxable income is approximately one-sixth of the value of agricultural produce.

If the production value of agriculture is compared with that for mines and industries, we find for the whole Union the following: *Agriculture*, £81½ million; *Mines*, £49⅓ million; *Industries*, £74½ million.

This comparison, therefore, also proves the great importance of agriculture to this country.

AMOUNT AND VALUE OF PRODUCTS.

The figures below are only approximate. The total production in each Province has been multiplied by the average price per unit. Unfortunately, the average price of live stock is not given, nor do any figures appear for fresh fruit, so that these two items have been left out. The figures are for the period 1st May, 1922, to 31st August, 1923.

Table I.—Field Crops.
Table II.—Animal Products.
Table III.—Comparative Figures for Provinces and Union.

Table I.—Field Products.

Product.	Cape.	Value.	Natal.	Value.	Transvaal.	Value.	Free State.	Value.
Wheat	1,492,893 bags	£1,903,470	3,263 bags	£4,162	224,510 bags	£286,250	86,715 bags	£110,562
Rye	189,431 „	156,016	135 „	115	3,668 „	3,118	30,787 „	26,169
Maize	861,223 „	617,210	1,517,094 „	1,080,929	5,280,629 „	3,762,448	8,108,334 „	5,777,187
Kaffir Corn	33,147 „	31,075	104,812 „	98,25[illegible]	463,113 „	434,168	392,199 „	367,690
Barley	343,197 „	204,488	690 „	411	40,848 „	24,339	3,499 „	2,085
Barley	2,636,681 bundles	9,278	73,119 bundles	256	747,374 bundles	2,616	202,818 bundles	710
Oats	876,841 bags	526,105	5,351 bags	3,212	129,213 bags	77,528	210,499 bags	126,299
Oats	11,625,220 bundles	608,300	1,197,375 bundles	23,100	9,793,684 bundles	169,000	11,710,989 bundles	226,100
Manna	1,491 bags	1,039	473 bags	347	5,113 bags	3,750	6,512 bags	4,775
Manna	683,489 bundles	8,373	522,396 bundles	6,400	1,236,093 bundles	15,132	5,934,747 bundles	72,700
Potatoes	370,410 bags	277,808	169,158 bags	126,869	488,136 bags	366,102	379,531 bags	284,648
Tobacco (Turkish) ...	518,768 lb.	64,846	—	—	—	—	—	—
Tobacco (other varieties)	2,551,628 „	63,791	392,572 lb.	9,814	4,972,481 lb.	124,312	131,671 lb.	3,292
Cotton	27,310 „	455	3,934,565 „	65,576	3,384,835 „	56,414	—	—
Chicory	1,658,146 „	20,726	1,200 „	15	28,095 „	251	4,000 „	48
Monkey Nuts	435 bags	198	14,483 bags	6,590	68,529 bags	29,880	754 „	343
Sugar	—	—	1,676,036 tons	1,445,681	—	—	—	—
Tea	—	—	2,861,745 lb.	15,899	—	—	—	—
		£4,493,178		£2,887,627		£5,357,308		£7,002,708

Table II.—Animal Products.

Product.	Cape.	Value.	Natal.	Value.	Transvaal.	Value.	Free State.	Value.
Butter	6,106,055 lb.	£432,502	1,456,863 lb.	£103,201	1,531,165 lb.	£108,458	1,457,282 lb.	£103,254
Cheese	217,931 „	10,897	21,524 „	1.076	126,222 „	6,311	181,914 „	9,096
Bacon and Ham ...	944,321 „	55,084	488.327 „	28,285	423,442 „	24,701	287,710 „	16,782
Wool	62,820.935 „	4,920,973	5,459.462 „	386,712	15,245.466 „	1.079,887	44,095,297 „	3.123,417
Ostrich Feathers ...	242,088 „	242,088	396 „	396	240 „	240	164 „	164
Mohair	8,797.946 „	549,822	58,870 „	3,679	64,784 „	4.049	221,526 „	13.845
		£6,211.366		£593.349		£1.223.646		£3.266,558

Table III.—Comparative Figures.

Products.	Cape.	Natal.	Transvaal.	Free State.	Union.
Wool	£4.920.973	£386.712	£1.097.887	£3.123.417	£9,512.989 (2)
Wheat	1.903,470	—	286,250	110.562	2.303,545 (3)
Oats	1.134.405	26.500	246.528	352.399	1.759.832 (4)
Maize	617,210	1,080.929	3,762.448	5,777.187	11.237.774 (1)
Mohair	549,822	—	—	—	571,395 (9)
Butter	432,502	103.201	108.458	103.254	747.414 (8)
Potatoes	277.808	126,869	266.102	284.648	1,055.427 (6)
Ostrich Feathers ...	242,088	—	—	—	242.888 (12)
Barley	213,766	—	—	—	244.183 (11)
Rye	156,016	—	—	26.169	—
Kaffir Corn... ...	—	98,251	434.168	367.690	931.184 (7)
Tobacco	—	—	124.312	—	266.055 (10)
Sugar	—	1.445.681	—	—	1,445.681 (5)
Cotton	—	65,576	56.414	—	—
Manna	—	—	—	77.425	—
Bacon and Ham ...	—	28.285	—	16,782	—
Tea	—	15,899	—		—

As is evident from this statement, maize and wool continue to be the country's principal products. In Natal, where they are exceeded in value by products of the sugar-cane, they still fill the second and third places respectively. In the Cape wool is first, while maize is fourth. Wheat and oats are second and third respectively.

DEATH RATE OF STOCK.

The figures below, taken from census returns, are indicative of the seriousness of stock losses in the Union.

During the period May, 1922, to August, 1923, the number of large stock lost through disease, drought, etc., was 196,281 in the Cape, 62,358 in Natal, 152,416 in Transvaal, and 124,732 in the Orange Free State, a total of 535,787 head of large stock for the Union, in little more than a year. To this must be added, the numbers of small stock similarly lost. 3,293,105 died in the Cape, 177,238 in Natal, 625,664 in Transvaal, and 1,201 in the Orange Free State. Together it gives a grand total of 5,207,787 for the Union. In other words, the farmers of the Union alone lost 535,787 head of large and 5,207,680 head of small stock through disease and drought in little more than a year. The losses sustained in native areas are not added. The returns do not show how many animals succumbed to drought alone; in fact it would be most difficult to determine this. Death in many instances may have been directly due to disease, but it is as probable that such disease may have resulted from lack of good feeding in times of drought. If it is assumed that only one-third of these stock losses is directly due to drought we are still faced with such considerable numbers as nearly 200,000 head of large and approximately 2,000,000 head of small stock. The estimate is naturally very low, but the number is already great, even when taken at this low proportion. If these statistics of large and small stock are capitalized at the lowest market prices ruling for stock between May, 1922, and August, 1923, they still yield a considerably large amount, showing the advantage of laying in a sufficient supply of fodder to enable us to save a considerable number of stock.

IMPORTATION AND EXPORT.

The report of the Controller of Customs on Union export and importation for 1924 shows that 1115 ships with cargo and 178 in ballast called at Union Ports during 1924. Of these 821 with cargo and 143 in ballast were of English nationalities, while the number of Dutch and German boats was respectively 63 and 64 with cargo and 5 Dutch boats in ballast. This shows that Dutch and German liners are the chief competitors with English companies on the South African route. It is further shown that English boats have landed cargo to the weight of 1,778,660 tons in South Africa and shipped 3,194,192 tons (bunker coal included), while cargoes for Dutch and German boats were respectively 264,733; 251,239 tons, and 250,656; 226,509 tons. It further appears that our ports have on 32 occasions been visited by South African boats. This shows that of the total South African shipping not 2½ per cent. is done by South African boats. During 1924, the Union's exports exceeded its imports to the value of £14,342,960. The surplus is approximately six million pounds less than in 1923, and four million more than in 1922. This decrease of 1924 on 1923 is largely due to the poor condition of the maize crop in the previous year. During 1924, 143,896,566 lb. of maize were exported, which represented an amount of £492,001, while the amount for 1923 was 1,128,314,250 lb. representing £3,084,334. The chief oversea markets in 1924 for South African

exported articles were provided by England, which bought 60.4 per cent. of the total export, India and other British possessions 20.4 per cent., Germany 3.8 per cent., France 3.7 per cent., Belgium 2.1 per cent., Holland 2.0 per cent., America 1.6 per cent., and Italy 0.9 per cent. There are indications however, that the percentage for England will probably be reduced during the coming years, while that of the Continent, Europe, and America will noticeably increase according to the degree of control exercised on these markets by South African merchants.

STAFF: APPOINTMENTS, CHANGES, ETC.

2/10/25 *W. S. van Heerden*, Senior Sheep and Wool Expert, Potchefstroom, transferred to Glen School of Agriculture.

1/10/25 *D. D. Morton*, Government Veterinary Officer, Eshowe, transferred to Police Headquarters, Pretoria.

6/10/25 *N. van Dalsen* appointed First Grade Inspector of Co-operative Societies, Pretoria.

15/10/25 *F. Roberts* appointed Lecturer in Poultry, Glen School of Agriculture.

17/7/25 *J. Martinaglia*, B.V.Sc., Research Officer, Veterinary Education and Research, Onderstepoort, transferred to Allerton Laboratory, Pietermaritzburg.

17/10/25 *D. J. v. d. Berg* appointed Field Husbandry Officer, Cedara School of Agriculture.

1/10/25 *A. R. Dragt*, B.Com., First Grade Clerk, Control and Audit Office, Pretoria, transferred as First Grade Inspector of Co-operative Societies.

1/10/25 *A. A. Smit*, B.Sc. (S. Africa), M.Sc.(Agr.) (Cornell), appointed Second Grade Economist in Division of Economics and Markets.

20/7/25 *C. R. Wyche* appointed Sheep and Wool Expert, Grootfontein School of Agriculture.

1/11/25 *Col. H. S. du Toit*, M.Sc(Agr.), D.T.D., Chief, Division of Extension, appointed Chief of Division of Education and Extension, Pretoria.

1/11/25 *F. J. du Toit*, B.A., Market Officer, Division of Economics and Markets, transferred to Mines and Industries.

4/10/25 *H. K. Munro*, B.Sc., F.E.S. (London), Entomologist, East London, transferred to Pretoria

7/11/25 *G. May*, First Grade Government Veterinary Surgeon, Veterinary Division, Transvaal, promoted to Senior Veterinary Officer, Queenstown.

3/11/25 *P. Koch* appointed Principal Tobacco and Cotton Officer (post of Chief, Division of Tobacco and Cotton, abolished).

9/11/25 *E. W. Sampson*, B.A. (Cambridge), N.D.D., Dairy Inspector, Dairy Division, Pretoria, appointed First Grade Economist, Division of Economics and Markets, Pretoria.

11/11/25 *O. T. de Villiers*, M.R.C.V.S., Government Veterinary Officer, Veterinary Division, Bloemfontein, transferred to Kroonstad.

1/11/25 *T. J. Naude*, B.Sc., M.Sc., Ph.D., Entomologist, Division of Entomology, Pretoria, transferred to Rustenburg.

9/11/25 *W. J. Lamont*, Principal, School of Agriculture, Elsenburg, appointed Assistant Chief, Division of Education and Extension, Pretoria.

28/11/25 *C. van E. Mare*, B.V.Sc., Government Veterinary Officer, Pretoria, transferred to Mafeking.

3/11/25 *W. H. Scherffius*, Chief, Division of Tobacco and Cotton, Pretoria, retired.

1/11/25 *F. E. A. Liebbrandt*, M.A., Technical Assistant, Soil Survey, Pretoria, appointed Chemist, Division of Chemistry, Pretoria.

3/11/25 *E. T. Fern*, Government Veterinary Officer, Mafeking, transferred to Bloemfontein.

1/12/25 *D. J. Seymore* appointed Journalist, Office of the Editor, *Journal of Agriculture*.

THE MAIZE JASSID.

(*Balclutha mbila* Naude.)

By C. P. v. d. Merwe, Division of Entomology, Durban.

The announcement by Mr. Storey, the Government Mycologist at Durban, that maize variegation, for long somewhat of a puzzle to observers, is a disease of the mosaic type and that it is carried by a jassid, *Balclutha mbila*, has aroused more than passing interest in this insect. It is therefore considered advisable to publish certain observations made upon it.

Method of Study.

The insects appear to do quite well in a glass tube open at both ends. A piece of muslin is tied over the top, and the bottom may be closed with a plug of cotton-wool; better ventilation is perhaps secured by using a cork with a hole punched through it and covered with a piece of muslin, instead of a cotton-wool plug. By means of a hook or a loop tied to the top the tube is suspended in an upright position. This ensures that the liquid voided by the insects does not fall on the side of the tube, which therefore remains clean longer, and does not need to be so frequently changed. If not too wide a tube is employed, one which does not exceed the focal length of the lens to be used in making observations, the insects can be examined without disturbing them. The tip of a leaf-blade of the food-plant is inserted into the tube alongside the plug at the bottom. To reduce transpiration and condensation of moisture on the inside of the tube, only the minimum amount of leaf surface necessary is supplied for the insects to feed upon. This method has to be varied somewhat when it is desired to keep eggs till they hatch. The leaf tip is very liable to dry out, and the young appear to be unable to emerge from the dry tissue. When only the tip of a leaf is put into the tube, it may wither and die before any eggs laid in it can hatch. It is well, therefore, to avoid the possibility of this happening by providing the females with a part of the leaf well away from the tip in which to deposit their eggs. A narrow leaf is selected, or a strip torn from a broader leaf, and is placed across the mouth of the tube so that the plug may be pushed in carrying the leaf before it. Another method, which I first saw used by Mr. Storey, is to put the mouth of the tube against the leaf and hold it in position by means of a suitable spring. Jassids, both adults and nymphs, are very jumpy, and will leap away on the least disturbance; but in the tubes they become rather disinclined to move, and trouble may be experienced in trying to

change the food. When the leaf is pulled out, they may cling to it till they are crushed against the tube, or they may get outside uninjured and escape. It is therefore advisable before withdrawing the leaf to insert a long pin, like a hatpin, through the muslin at the top, and carefully touch the insect, when it will jump away from the leaf.

DESCRIPTION.

The eggs are white in colour and about one-fiftieth of an inch long. They are inserted into the leaf substance, and unless laid in the midrib are visible from either side of the leaf. Except for the appearance of two black eye-spots, not much change can be observed going on until the young hatch.

The nymphs are white with two black eyes when hatched. They have no wings, but otherwise resemble the adult in shape. Sooner or later a purple mark appears on the upper side of the thorax and abdomen. The portion on the thorax has the shape of a trapezium, and that on the abdomen the shape of a triangle with its apex towards the thorax. This mark may appear as early as after the first moult; if not, it may show up after any subsequent moult. The wing pads are to be seen clearly after the third moult.

The adult is a small insect, about three-fiftieths of an inch long and of the characteristic jassid shape, widest across the head, and from there narrowing posteriorly. When at rest it appears to be longitudinally striped, having a light yellow line down the back, then a dark band on each side over the thorax and wings, and a narrow light outer edge to the upper wings. The upper side of the body under the wings is black or purplish black. The colour of the head, legs, antennae, and underside of the body is light brown or yellowish with a greenish tinge under the abdomen, probably from the contained food. The eyes are black, and in front of the eyes, closer together, are two round black spots simulating nostrils.

LIFE-HISTORY.

Incubation.—The eggs have been found to take from nine to twenty-one days to hatch. The longest period occurred with eggs laid towards the end of the month of August. From then onwards there was a gradual, though not always regular, decrease in the period of incubation, till the minimum was reached with eggs laid between Christmas and New Year. Eggs laid during January took ten to eleven days to hatch, and apparently after that the egg stage continues to lengthen. It is also thought that during the colder months the stage might be even longer than that recorded for August.

Nymphal Instars.—The nymph moults five times, reaching the adult stage at the fifth moult. The following table shows the number of days between the various moults and also the total nymphal periods observed. The observations were made during the months of

November, December, and January. During the colder months, the nymphal period is probably also prolonged.

Number of Moult.	1st.	2nd.	3rd.	4th.	5th.	Entire Nymphal Period.
Maximum	6	5	7	9	11	31
Minimum	2	2	2	3	2	18
Average	4·1	3·1	4·0	5·0	7·2	23·0

Two nymphs took fourteen days from the third moult before passing the fourth, and they were then thirty days old. As both died before becoming adult, they were probably not normal insects, and their records are omitted from the calculations for the above table.

Imago Life:—*The Adult.*—The length of time the adult may remain alive has not yet been ascertained. Probably it lives for several months. Females were found to start egg-laying from six to fifteen days after reaching the adult stage. One female laid 339 eggs in thirty-six days. The greatest number of eggs deposited in one day was twenty-two, but on the preceding day the leaf on which the insect was feeding had turned yellow and no eggs were laid. The greatest numbers of eggs found on other days were sixteen, seventeen, and eighteen.

FOOD PLANTS.

The insect is commonly found on maize and sugar-cane on the Natal coast. It has been successfully fed on Napier fodder grass and *Digitaria* sp., and it is likely that it will thrive on most of the grasses. No attempt has been made to feed it on other plants.

NATURAL CONTROL.

By its activity the jassid probably escapes many enemies that prey upon small insects. In the egg stage, however, it is attacked by a parasite, which may be the principal factor in preventing its excessive increase. Parasitized eggs may be recognized by the appearance of a red spot, which is the developing parasite. From these eggs a small reddish-brown parasite emerges. It has not yet been identified.

Though the jassid has not yet been observed to multiply to enormous numbers as some other small insects, such as aphides do, it does represent a very potent agent in spreading maize variegation. Every season there appears to be a sufficiency of this species to provide widespread manifestations of this morbid conditon of the maize plant.

THE MANURING OF TRANSVAAL SOILS.*

By T. G. W. REINECKE, B.A., M.Sc.Ag., Principal, Potchefstroom School of Agriculture and Experiment Station.

* Originally published as Departmental Bulletin No. 81, 1915, and now revised.—EDITOR.

PLANT FOOD.

THE soil contains certain ingredients which are essential for the growth and development of plants. When a plant is burned up, ash remains. If this is examined we find, amongst other things, lime, magnesia, potash, iron oxide, sulphates, and phosphates. Nitrogen in the form of ammonia, carbon dioxide, and water are driven off into the air by the process of burning. The above-mentioned constituents are the plant foods.

SOIL IN GENERAL.

The soil contains, generally speaking, sufficient iron oxide, magnesia, sulphates, and even lime for the actual food requirements of any crop. Sometimes we apply lime to soil when the ground is sour to neutralize this, since a state of sourness in the soil spells infertility, especially if it is proposed to grow lucerne, tobacco, or other lime-loving crops. Further, carbon dioxide is obtained by plants from the air in as great amount as required, and, obviously, water is necessary for all the growing processes in plants. Now, three plant foods remain, viz., phosphates, nitrogen, and potash. These three are important because (1) plants remove more of these ingredients from the soil than any other; (2) ground often contains too small an amount of one or all of these three ingredients in a form suitable to meet the immediate requirements of a crop. For these reasons it is often necessary to apply one, two, or all three of these constituents to the soil as manure.

KRAAL OR FARMYARD MANURE.

A manure is an article that contains one, two, or three of the ingredients—phosphates, potash, and nitrogen. Kraal manure contains all three, and is therefore the safest and best (this will be shown later) manure a farmer can use, because it will put back into the soil all three of the constituents which are removed in large quantities by the crop and which may run short at one time or other in the soil.

ARTIFICIAL MANURES.

Where kraal manure is not obtainable, or where the farmer has not sufficient, he is obliged to use artificial manures. Often artificial manures have not all three constituents, so that manuring by these means requires a little thought and study. For instance, a farmer cannot manure his land year after year with a manure

supplying only one of the three ingredients and expect always to get good results, because the crop takes annually as well a good deal of the other two constituents out of the soil.

Superphosphate contains nothing but phosphates. Good results are obtained the first three or four seasons on the majority of the Transvaal soils if this manure is applied alone, whether for oats, wheat, mealies, or even potatoes. One cannot expect, however, that this will continue, because the crop on each occasion removes nitrogen and potash, in addition to the phosphates applied.

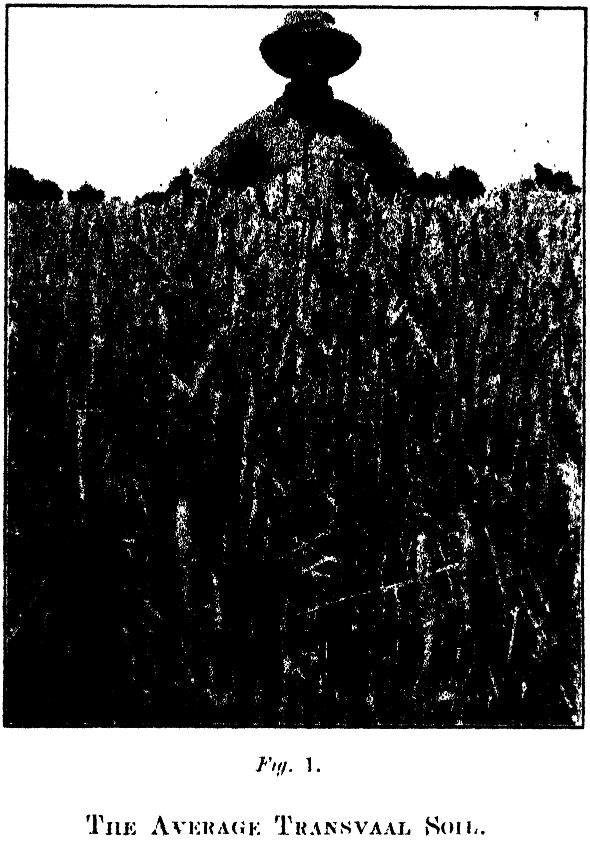


Fig. 1.

THE AVERAGE TRANSVAAL SOIL.

An average of 100 analyses of Transvaal soils from various parts of the Province, carried out by the Transvaal Department of Agriculture prior to Union, showed the average soil to be "poor" in phosphates, "medium" in nitrogen, and "good" in potash. These analyses, and others since made at this Institution, bear out this general conclusion. On this account we find it necessary in practice to apply only superphosphate to oats, wheat, or mealies for the first few seasons. After that it becomes necessary to bring in nitrogen with the phosphates in the system of manuring. (In passing it may be mentioned that the best phosphatic manure is superphosphate, unless the soil is acid or "sour," when basic slag, bonemeal, or a mixture of

bonemeal and superphosphate must be used in its stead.) It is, generally speaking, not necessary to apply a manure containing potash to the soil for many seasons, especially where cereals are grown, and more so if thorough and good cultivation is practised, for by that means potash is rendered available in the coarse soil particles and bits of stone. Thus it is not economically sound, in most cases, to manure crops with one of the so-called "special fertilizers," because, although these manures contain all three manurial ingredients, the potash is not usually required, nor at first the nitrogen, both of which ingredients are expensive.

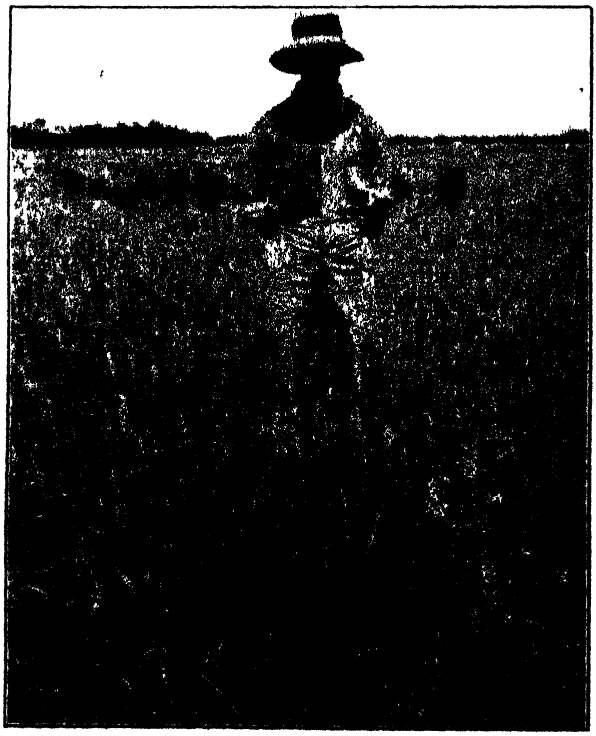


Fig. 2.

HUMUS.

There is a soil ingredient called humus. This ingredient is formed by the partial decay of grass, straw, leaves, roots, and other materials of vegetable and also animal origin. Humus, although it does not serve directly as a plant food, contains plant food constituents which are easily put at the disposal of a crop. Above all, humus assists the soil to retain a good deal of the water which finds its way there from rain, and is thus an indispensable constituent in our soils, especially where dry-land culture is practised. Our soils are deficient in humus, and our object should therefore not only be

to supply plant foods as such to the soil, but also humus. Kraal manure contains the plant foods as well as humus, and it is for this reason that we value it more than any artificial fertilizer.

MANURING OF SPECIAL CROPS ON THE AVERAGE TRANSVAAL SOIL.

It is impossible to lay down a system of manuring which can be said with certainty will yield the best results in all cases, but on the average soil of the Province the following are recommended:—

(1) *Mealies, Oats, and Wheat.*

Even if the farmer had kraal manure and could plough this under on the mealie, oat, or wheat lands every three years, he could

Fig 3

with advantage still apply 100 to 200 lb. superphosphate per acre in the intervening years, for the reason that our lands are so poor in phosphates. By such means not only will the best harvest be obtained, but the productive power of the land increased for the seasons ahead. This system is an excellent one for whatever crop it is proposed to grow.

Unfortunately, kraal manure is scarce in the Province, and whatever little there may be is generally put aside by agriculturists for

potatoes and other roots. If kraal manure is not procurable, then for the first few seasons superphosphate should be applied at the rate of 100 to 200 lb. per acre (basic slag, bonemeal, or a mixture of bonemeal and superphosphate instead of superphosphate on sour soils). In the meantime it can be ascertained by means of a trial just when it will pay to apply nitrogen with the phosphates. This is done by manuring a fair-sized piece of ground with a mixture, two parts of superphosphate and one part of blood manure, the quantity of the former per acre being the same as applied to the main crop. It will be found that about the fourth season the soil will require treatment by which nitrogen can be brought in.

Fig. 4.

A good and profitable way of bringing nitrogen into the soil is by growing a leguminous crop, such as peas or beans, and ploughing this under as soon as the plants are in flower. Leguminous plants get a good deal of nitrogen from the air. By turning under such a crop the soil is enriched in nitrogen. In addition, by the decay of the leaves, stems, and roots of the plants, a good deal of humus is added to the soil. All that is required for the ensuing crop of mealies, oats, or wheat is a dressing of a phosphate. The harvests from such a system will surprise any one not acquainted with it.

Instead of leaving our exhausted mealie lands to lie idle for some years and to grow nothing but poor "queek," it would prove a profitable scheme to grow a cheap legume, such as kaffir beans, with or without the application of a small dressing of phosphate, and to turn this under betimes. Land so treated would give good returns the following season when manured with phosphates.

It is always convenient to grow and plough under a leguminous crop, in which case nitrogen can be applied in the form of Government guano in conjunction with phosphate (one part by weight of each, or one part of former and two parts of latter). If guano is not procurable, then blood manure (one part to every two parts of phosphate) can take its place. Blood manure is sold cheaply by

Fig. 5.

certain public abattoirs, such as the municipal abattoirs at Newtown, Johannesburg, and Pretoria.

(NOTE.—Basic slag should not be directly mixed with guano or blood-meal, but applied separately.)

Figures 1 and 2 show the effect of superphosphate only on wheat on ground that had received the same treatment for two years. No. 1 received superphosphate at the rate of 200 lb. per acre and No. 2 no manure. The experiment was started by the writer on new ground in

1910, and photos were taken at time of the second crop in 1911. No. 1 yielded a harvest of something like six bags of grain to the acre, and No. 2 three bags to the acre. After deducting cost of superphosphate from the value of the extra three bags resulting from its application, there was a profit of £1. 10s. 8d.

Figures Nos. 3 and 4 were taken in 1912 in an experiment on oats on soil adjacent to the wheat plots and similar in type. The trials were started in 1907. The first three years, 1907-08-09, the plot receiving superphosphate alone was the best (out of a total of twenty-six plots of single manures and combinations thereof). After that time, 1910, and onwards, the plot which received a nitrogenous manure, together with superphosphate, was the best. No. 3 shows

Fig 6.

the plot which received superphosphate 200 lb. and blood manure 140 lb. per acre, and No. 4 is a no-manure plot adjoining. No. 3 yielded oat-hay at the rate of 3,890 lb. to the acre, and No. 4 1,660 lb. to the acre. The superphosphate and blood manure gave a clear profit of £4. 8s. 6d. per acre.

(2) *Potatoes.*

Kraal manure is indispensable if a success is to be made of potato growing. The potato does not only require the plant foods in the kraal manure, but also the organic matter or humus present. If a

farmer has not sufficient kraal manure (and even though he has), it pays to spread 600 to 1,000 lb. of superphosphate per acre in the drills with the potato seed. If kraal manure is out of the question, then the potatoes can, with advantage, be grown on land where leguminous green manure was previously ploughed under, to be followed by a dressing of superphosphate in the drills at planting. Failing this, a mixture of about 1,000 lb. per acre of superphosphate and Government guano in equal quantities spread in drills has given good results. Meat-meal is a good substitute for guano.

(3) *Lucerne.*

This crop gets all the nitrogen it requires from the air, provided always that the soil has sufficient lime and the crop is well established. For this reason lucerne growers do not generally apply a manure containing nitrogen. The lucerne plant produces humus in the soil by the rotting of its own leaves and roots. We prefer, therefore, to keep our kraal manure for some other crop. Superphosphate is, in the majority of cases, all that lucerne requires—a dressing of 400 to 500 lb. per acre. Wherever lucerne is to be established, it is a very sound policy to plough under a good heavy dressing of dung or kraal manure for various reasons, one of which is that the young lucerne plant will require to get its nitrogen from the soil until it is strong and vigorous enough to draw its nitrogen from the air.

Figures Nos. 5 and 6 show the effect of a dressing of 400 lb. superphosphate per acre to lucerne on a black-clay loam on the farm Gerardminnebron, at the eye of the Mooi River, Potchefstroom. The experiment was started in August, 1911, and was continued for three seasons, the plots receiving the same treatment annually. The photographs were taken on the same day, 21st December, 1912, just at the time of the third cutting and in the second year of the experiment. No. 5 represents the plot which received superphosphate at the rate of 400 lb. per acre, and No. 6 the no-manure plot. No. 5 gave a return for the season 1912-13 of 4½ tons hay per acre, and No. 6 only 2¼ tons hay per acre—a total of six cuttings in each instance. The application of 400 lb. superphosphate brought in a net profit of £11 per acre for the season.

Often good results are obtained by the application of lime to lucerne. Everything, of course, depends on whether the soil is wanting in lime or not. It is doubtful whether it will pay to attempt to grow lucerne extensively on soil that is sour or very deficient in lime unless the farmer can obtain very large quantities of lime cheaply.

INQUIRIES AND REPLIES.

SELECTED LETTERS FROM FARMERS.

[Hereunder are a number of recent letters replied to by the various Divisions and Schools of Agriculture concerned. They are selected for publication as being of interest to farmers generally in the localities affected. In each case the area only from which the inquiry emanates is given; as the replies must necessarily be curtailed, they will indicate, when required, literature from which further information may be had. All departmental bulletins quoted are obtainable on application to the Editor.]

Cultivation of Pineapples.

Louis Trichardt.—Could you please give me some information on the cultivation and harvesting of pineapples?

The Chief, Division of Horticulture, replies: The pineapple is one of the simplest fruits to grow under right conditions of soil, climate, water, etc. Break up your soil, get the suckers, and plant them out, say, 3 feet by 5 feet or 4 feet by 3 feet or 4 feet by 5 feet—there is no hard and fast rule. Continuous cultivation is one of the secrets of success after the pines start growing. Keep the cultivator going between the rows. Suckers are obtainable from the Langholm Estates, P.O. Langholm, at very low rates—something like 5s. per 1,000. There are two varieties of pines grown generally in this country: The Natal Queen, which is a small well-flavoured fruit, carries well, but on account of its small size it is not so suitable for canning. The export weights are 1¼ to 1½ lb. The other variety is the Cayenne or Giant Kew, for which the export weights are from 2½ to 4 lb.; it is a smooth-leaf pine, perhaps not as high-class for the table as the smaller Queen. Suckers may be planted at any time during September and October. Factory prices run from 9d. to 1s. 6d. per dozen. The Cayenne on account of its size commands a somewhat higher price.

In harvesting for export they should be cut with a certain amount of stem attached, ½ inch in the case of the Queen and 1 inch on Cayenne, and the whole crown should be left on the pine. The soil must be well drained. This fruit seems to thrive best on fairly steep slopes.

Tuberculosis in Pigs.

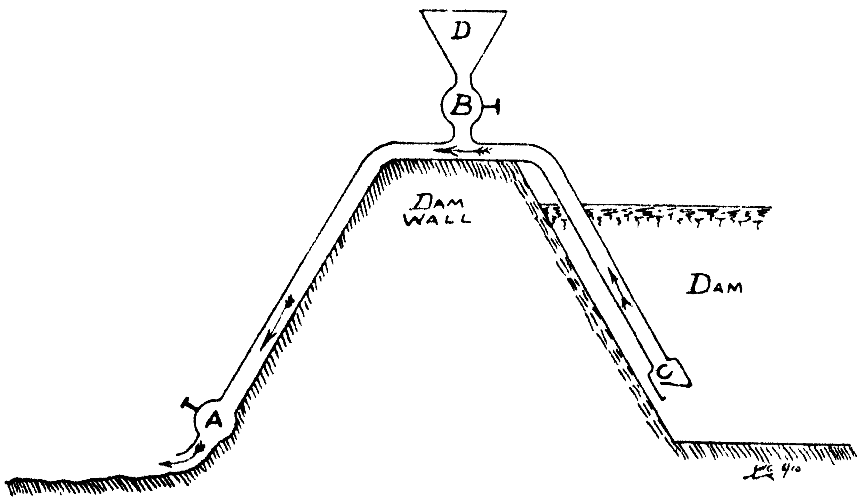
Creighton, Natal.—Last month, of 17 pigs sent away to two different firms, 13 were condemned for tuberculosis; although only one carcass was totally condemned, the rest had it in various parts of the body, such as the head, etc. All were bought as weaners and have been well fed on mealies, milk, water, and green foods. My sties are all concreted, with wooden platforms for the pigs to sleep on, and are cleaned out every day. Two of my neighbours got some of

the same lot of pigs, and theirs were quite sound. Is there any possible cause of the disease, and what must be done to eradicate it?

Cedara School of Agriculture replies: (1) Possible cause of disease: There are two possibilities—these pigs were affected at time of sale, or contracted it on your farm. The first does not seem possible, for the reason that only one had generalized disease as shown by total condemnation. If they had had it at time of buying as weaners, most would now have been condemned totally, for with the pig, generalization takes place quickest. Perhaps you have possibly been feeding them on tubercular milk, or they have been in contact with other tubercular pigs. (2) A general tuberculosis test of all your cattle is suggested. Any pigs showing enlarged joints with signs of wasting, swollen throats, or wasting alone, must be considered as highly suspect.

Syphoning Water.

Springfontein.—Please advise me in connexion with the syphoning of water out of a dam.



Glen School of Agriculture replies:—The great fault of a syphon is that since the pressure in the pipe at the crown (top) is less than atmospheric pressure, the water easily gives up its air, which accumulates at the crown and finally breaks the continuity of the water; then the syphon ceases to operate. Syphons prove troublesome when made of piping of small diameter, and the bigger the piping the better are the results obtained. A useful arrangement is shown in the accompanying sketch. To prime the syphon (i.e. to start the operation) proceed as follows:—Close valve A, open valve B; then valve C, which is self operating, will close automatically. Fill the syphon with water through the filling cup D, then close valve B and open valve A quickly, when syphon will again operate.

"Shooting the Red" in Turkeys.

Brandfort.—What does "shooting the red" in turkeys mean? What is the best feed for young turkeys?

Glen School of Agriculture replies: "Shooting the red" is the term applied when young turkeys commence showing the red fleshy part around the head and throat, usually at about six weeks of age. After they have shot the red, they become far more hardy than previously.

For the first few days they require very little feeding, but warmth is essential. Thick milk is an excellent food from the start. A moist mash consisting of equal parts bran and mealie-meal damped with thick milk is very good; cracked maize is quite suitable as a grain feed. Onions cut up finely are relished. After the turkeys have shot the red, mealies as a grain, along with dry mash always before them, is all that is required. Plenty of green food is essential, also free range when the turkeys have developed.

Treatment of Parasites in Poultry.

Johannesburg.—What treatment is recommended for tapeworms, round worms, and lice on poultry?

Potchefstroom School of Agriculture replies: It is suggested to use either turpentine or lye. In using turpentine, first fast the birds for twenty-four hours, during which time they should be given some epsom-salts. One teaspoonful of salts is allowed for each bird, the whole being dissolved in warm water and mixed with mash. The following morning the turpentine may be given in a dose of from one to two teaspoonfuls per bird. Owing to the offensive qualities of turpentine, it is not possible to give it in food, but it must be administered to each bird individually. Introduce the dose into the crop by means of an oiled rubber tube inserted through the mouth and oesophagus. The turpentine, diluted with an equal amount of olive oil, may be administered by the mouth. Three or four hours after giving the turpentine, the birds should receive another laxative dose of salts, administered in the mash as before. Owing to the resistant nature of tapeworms, it would be advisable to repeat the vermifuge treatment in about three weeks.

A tablespoonful of concentrated lye may be added to about a gallon of wheat and oats, and this may be cooked slowly for about two hours. This mixture may then be fed to the birds. A second dose should be given twelve hours after the first one.

The tobacco treatment is very efficient against the round worm. Take one pound of finely-chopped tobacco stems and steep them for two hours in just enough water to keep the mass covered. The liquid and the stems are then mixed with the mash and this is then given to one hundred birds. Two hours later the birds should be given some epsom-salts. This treatment should be repeated in two weeks.

The best remedy against lice is sodium fluoride. Thoroughly dust the birds with this powder at least once a month while they are infested with lice.

Cost of Feeding Poultry.

Maritzburg, Natal.—Can you give me any information as to why my egg production costs so much? The hens average 150 eggs per annum, or just over one dozen eggs per hen per month. The best quality of feed is bought and only a bag of each kind at a time. The result is that each hen costs 9½d. to feed and only lays one dozen eggs.

Cedara School of Agriculture replies: When foodstuffs are bought by the bag the cost of feeding is usually higher in price than when bought in bulk. The present prices of different feeds are as follows per 100 lb.:—Pollard, 9s. 6d.; bran, 9s.; lucerne meal, 12s. 6d.; meat meal, 12s. 6d.; crushed yellow maize, 15s. 6d.; wheat (best), 15s. 6d. The approximate cost of food per month per bird, fed on a balanced ration made up of the above ingredients, is approximately 9½d., which is considered reasonable. This could be reduced considerably if the foodstuffs could be bought in bulk during the cheap season and stored in a dry place and away from rats.

Your flock average is 150 eggs per bird per annum and the cost of feeding is 9½d. per every dozen of eggs produced, so that the cost of producing 150 eggs, i.e. 12½ dozen, per bird per annum is approximately 9s. 11d. The price paid by the Natal Co-operative Egg Circle per 1 dozen eggs was 1s. 10½d. Therefore at this price your 12½ dozen eggs would bring in 23s. 5d. less 9s. 11d. cost of feeding, a profit of about 13s. 6d. per bird, which is considered very good for the flock average production of 150 eggs per bird per annum. In order to increase the flock average production, it is necessary to do culling to remove the inferior birds that are keeping down the average.

Barnevelder Fowl.

Carolina.—Will the Barnevelder become a first-class competitor of the egg-laying breeds in South Africa? Is there any book giving descriptive accounts of the different breeds with regard to conformity to type, skeletal structure, etc., of the ideal egg-producer?

Potchefstroom School of Agriculture replies: The Barnevelder is a new breed and as such it has gained popularity and is still finding favour among many poultrymen. It will never really supplant the more established breeds of egg-producing qualities, and even should it become a competitor it could not hurt such breeds as the Australorpe, Plymouth Rock, Rhode Island Red, and Leghorn.

The best book recommended is one published by the Reliable Poultry Journal Publishing Co., Dayton, Ohio, U.S.A., viz., "Profitable Culling and Selective Flock Breeding." This is a valuable book on the question of selection and culling.

If bred for high egg-production, provided there is a good strain of any of the egg-laying breeds, you ought to get an intensity of production per bird of at least twenty eggs per month during the more favourable months of the year, and at least twelve to fifteen eggs per month during the winter months. If not, cull your flock more rigidly.

After selection, feeding is one of the most important considerations. If the methods of management and feeding are correct, the birds will respond to high egg production.

Stabling of Horses and Cows.

Belmont, O.F.S.—Please supply particulars regarding suitable dimensions for horse and cow stables. Why is it considered better to stable animals tail to tail?

Glen School of Agriculture replies: Horses and cows are stabled tail to tail to prevent the animals on one side of the stable breathing the foul air expelled from the lungs of the animals stabled on the opposite side. Also all excreta, urine, etc., is confined to one part of the stable, i.e the central passage. When animals are stabled head to head infectious disease is more easily spread.

The internal dimensions of horse and cow stables vary slightly according to the sizes of animals to be stabled. The following measurements will serve as a guide, viz. (*a*) Stable for large work-horses:—Length of stall from wall in front of horses' heads to edge of urine channel next horses' hoofs, 10½ feet, width of stall 6 feet: (*b*) stable for Cape-cart and carriage horses:—Length of stall 9½ feet, width 5½ feet. The remaining dimensions are according to choice, suitable sizes being as follows:—Width urine channel 1 foot, width passage 5½ to 6 feet. The air space per horse should not be less than 1,000 cubic feet.

A cow stable may be provided with three passages, one central 6 feet wide, and two side (feeding passages) about 3½ feet wide, i.e. large enough to permit the passage of feed-barrow. In a stable for the larger breeds, the average length of stall plus manger is 8 feet, and is arranged for different sized cows, as—Jerseys and Kerrys, 6½ to 7 feet; Ayrshires, 7 feet; Cross-bred cows of average size, 7 to 7½ feet; Shorthorn, Fries, 7½ to 9 feet. The width of each *double* stall for larger sized cows should be from 7 to 7½ feet and for smaller cows 6½ feet. The cubic air-space per cow should be between 600 and 700 cubic feet.

If desired the feeding passages of the cow stable may be omitted, the mangers being constructed against each side wall; the arrangement will cheapen the construction greatly, but provides an inferior stable.

Short Course, 1926.

Frankfort.—(1) When will the next short course be held and when should application be made for it? (2) Are the subjects of a general nature? (3) Can the following courses be taken at the same time, e.g. maize, sheep and wool, and poultry? (4) What is the cost of board and lodging and the fees for each subject?

Glen School of Agriculture replies:

(1) Annually, during June and July. Applications should be made as soon as possible. Pamphlets in connexion therewith are issued during March and July, and preference is given to applicants who have not attended any short courses yet.

(2) No. Only special subjects, e.g. sheep and wool, poultry, etc., in each course; only one subject is dealt with.

(3) No. These courses cannot be taken simultaneously; possibly it can be arranged to take one in the one week and another in the next.

(4) Fees, 30s. per week, including board and lodging.

Contagious Vaginitis in Cattle.

New Hanover, Natal.—Does contagious vaginitis cause sterility in the bull as well as in the cow, and is it possible for a calf to be born with the disease?

The Director of Veterinary Education and Research replies: The affected bull does not become sterile, but, owing to changes in the genital organs, hesitates to serve. Heifers can become infected when still very young, 30 to 40 days old, and commonly show signs of infection as yearlings. There is no clear evidence available to show that calves can be born with the disease.

Our recent observations tend to show that actual sterility is not set up by this disease, as is so commonly believed by farmers. In cases where sterility is found to have developed, it is almost invariably the result of drastic treatment which is very often applied. What does happen, however, is that animals in the acute stage of the disease, particularly young heifers, frequently return to the bull and fail to conceive immediately. Repeated service in such cases aggravates the condition. Acute cases, both heifers and cows, should therefore be submitted to treatment about a month before service, the object being to allay the irritation which is present in the vagina. The treatment now recommended is as follows:—Obtain from a chemist Lugol's iodine solution, and for use make up a ½ per cent. solution in boiled water. Wash out the vagina with this, and on the following day swab out with a mixture consisting of 1 part iodoform, 1 part bismuth subnitrate, and 25 parts olive oil. The swabbing can be done conveniently by means of cotton-wool fixed at the end of a stick. The treatment, as indicated here, should be repeated at least twice a week. In the case of heifers only showing a few nodules and not treated before service, they should be submitted to treatment 24 hours after service. In this case it will be sufficient to swab them out once or twice with the mixture previously given.

Feeding Late Chicks.

Paddock, Natal.—Is cod-liver oil good for late chicks which are fed on dry mash? Is buckwheat good to include in the grain mixture? In order to provide a balanced ratio what other foods to bran, pollard, fish, and lucerne meal should be given if crushed maize is fed exclusively?

Cedara School of Agriculture replies: Late-hatched chicks never do so well as the early hatched ones, i.e. chicks hatched in October and November do not develop as well as chicks hatched in June, July, and August. Cod-liver oil is excellent for growing chickens and would certainly help to push on late-hatched chickens quickly. Give four tablespoonfuls to 100 chicks when beginning to use the cod-liver oil, then gradually increase up to twelve tablespoonfuls per day. The oil should be worked into their early morning feed of mash, and care must be taken to distribute evenly the oil through the mash. The chicks must be kept warm and dry—this is essential. Feed them frequently during the day, and at night, say about ten o'clock, take

a light and give them an extra feed; this helps to develop chicks quickly. Always give them plenty of clean, fresh water and keep the drinking-vessels scrupulously clean.

Skim-milk is a valuable chicken food and may be fed sweet or preferably sour, as sour milk has a most favourable influence on growth and vigour and is an important agent in the reduction of mortality from all causes. It has been found that the addition of skim-milk to a ration increased the consumption of other food. When feeding skim-milk it is essential to see that all utensils are thoroughly cleaned—preferably scalded—especially in warm weather.

Buckwheat, owing to its large proportion of crude fibre, has a lower percentage of digestible organic matter than any of the other grains, except oats. Fowls do not eat it readily on account of its dark unattractive appearance; it also has a tendency to cause light-coloured yolks. Wheat is considered necessary for chick rearing.

Cultivation of the Castor-Oil Plant.

Johannesburg.—Could you please give me any information as regards the growing and treatment of castor-oil plants.

The Division of Field and Animal Husbandry replies: The cultivation of castor-oil plants has been tried in South Africa for some little time and with varying success. However, from the experience of growers and the results of experiments, the following lines of procedure seem necessary to ensure success:—

Being a sub-tropical plant, only the warmer low-lying districts are suited to its culture. In fact, it is so sensitive to frost that experience has shown that it is not advisable to attempt the culture on a large scale above 2,500 feet altitude. It is best to treat the plants as annuals, replanting every year. The best kinds to sow are the small-seeded wild varieties, particularly the one known as "Madras." The medium and large seeded kinds, especially *Ricinus lividus* and *Ricinus zanzibarensis* variety *viridis*, can be grown and do well on drier soils; but these should be treated as perennials, and sown eight feet by eight feet apart. The smaller kinds must be sown four feet by five feet apart, two seeds being planted in one hole—later thinned to one—and cultivated as for maize. The best time to sow is in October and November. These plants, on good clayey loam soil and well cultivated, will thrive with just rain-water, but better results are secured by irrigation, the natural habitat of the plants being river-sides. The soil should be a rich deep clayey loam to a loam soil—not sandy; and as the castor crop is very exhaustive to the soil, heavy manuring with phosphatic and nitrogenous manures is necessary. The yield per acre on good soils and with proper cultural treatment is between four and five cwt., but higher yields have also been recorded. The insect and fungoid enemies are many and are one of the chief drawbacks to success with this crop. Of these, the borer is one of the worst.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Government Gazette*:—

(Abbreviations: "Proc."-Proclamation "G.N."-Government Notice.)

Gazette. No.	*Date.*	*Items.*
		Dipping.—The compulsory dipping and disinfection of all cattle has been ordered as follows:—
		Every five days in the five-day dipping-fluid on—
1509	16/10/25	(*a*) Klein Zeekoe Valley, Pinetown District, Natal. (G.N. No. 1781.)
1510	23/10/25	(*a*) Allandale and all areas served by the dipping-tank thereon, Pietermaritzburg District, Natal. (G.N. No. 1837.)
1515	27/11/25	Lots Nos. 242, 243, 245, 246, 290, 292, 289, 296, 285, 284, 283, and 254, Lower Umfolozi District, Natal. Boschhoek No. 489, Langverwacht No. 476, Doornhoek No. 304, and Hollandia No. 384, Vryheid District, Natal. Blackhill No. 1068, Gallashill No. 1087, Sweethome No. 1082, Les Fontaines No. 1079, Springfields No. 1078, La Rochelle No. 1080, Normandy No. 1081, Silvermyn No. 1085, De Villiersdale No. 1084, Montblanc No. 1083, De la Roche No. 1087, Bonne Esperance No. 1088, and Non Perella No. 1086, Pietersburg District, Transvaal. (G.N. No. 2100.)
		Every seven days in the seven-day dipping-fluid on—
1512	6/11/25	(*a*) that portion of Potgietersrust District, Transvaal, from and including the farm Heelfraai No. 74, along the boundary of the Potgietersrust-Pietersburg Magisterial Districts in a south-easterly direction to the farm Chlun No. 258; thence in a westerly direction along the boundaries of and including the farms Gibeon No. 703, Hamburg No. 592, Vlakfontein No. 590, Goedehoop No. 928, Elandsfontein No. 946, Van Wykspan No. 589, Kromkloof No. 876, and Doornfontein No. 660; thence in a northerly direction along the Magalakwin River to where it joins the Pietersburg Magisterial District (G.N. No. 1963);
1515	27/11/25	(*b*) the Blaauwberg Police Area, Pietersburg District, Transvaal (G.N. No. 2099).
		The compulsory dipping of sheep and goats has been ordered as follows:—
1512	6/11/25	(*a*) In certain locations and farms in the Umzimkulu District, Cape, between the 15th November, 1925, and the 31st January, 1926. (G.N. No. 1964.)
1514	20/11/25	(*b*) In Gxaku Location No. 23 and Ludidi Location No. 11, in Mount Fletcher and Matatiele Districts respectively, Cape Province, during the period 1st December, 1925, and 31st January, 1926. (G.N. No. 2021.)
1516	4/12/25	(*c*) In Moshesh's Location, Matatiele District, Cape, between the 15th December, 1925, and 31st January, 1926. (G.N. No. 2140.)
1514	20/11/25	Every owner of sheep and goats in the Districts of Aliwal North, Albert, and Venterstad, Cape, whose sheep (*a*) have been scab-infected during the twelve months ended 1st December, 1925, and (*b*) whose sheep have been in contact with any sheep referred to in (*a*) during the six months ended 1st December, 1925, shall cause the same to be dipped twice during the period 1st December, 1925, and 28th

1515 27/11/25 February, 1926 (G.N. No. 2029); also in the District of Hay, Cape, between the 2nd January and 31st March, 1926 (G.N. No. 2067).

1512 6/11/25 The compulsory dipping and hand-dressing of all horses, mules, and donkeys has been ordered as follows: Every seven days in the seven-day dipping-fluid in North Camp, Town Lands, Ficksburg, Orange Free State. (G.N. No. 1962.)

1509 16/10/25 Certain dips have been sanctioned as "approved dips" for the dipping of infected sheep under official supervision. (G.N. No. 1783.)

1509 16/10/25 *Fencing.*—Contributions towards the cost of dividing fences have been declared obligatory (*a*) in Ward Secocoeni, Middel-
1514 20/11/25 burg, Transvaal (Proc. No. 242); (*b*) on certain farms in Ward No. 7, Gordonia District, Cape (Proc. No. 274).

Contributions towards the cost of (*a*) converting dividing fences into vermin-proof fences, and (*b*) erecting vermin-proof fences as dividing fences, have been declared com-
1509 16/10/25 pulsory in the following areas: Ward No. 3, Venter,
1512 6/11/25 District Philipstown, Cape (Proc. No. 243); Ward No. 1, District Richmond, Cape (Proc. No. 263); Ward No. 5, Somersdale, District Victoria West, Cape (Proc. No. 264);
1513 13/11/25 Ward No. 4, Doornhoek, District Maraisburg, Cape (Proc. No. 270).

1509 16/10/25 *Crown Lands for Disposal.*—The following pieces of Crown land will be offered for sale by public auction at the places and on the dates specified:—

The farm Sandkraal, in extent approximately 70 morgen, in the District of Piquetberg, at the Court-house, Piquetberg, on the 13th January, 1926.

Farm No. 15, in extent approximately 98 morgen, and farm No. 24, in extent approximately 10 morgen, both in the District of Port St. Johns, at the Court-house, Port St. Johns, on the 29th January, 1926.

1511 30/10/25 Certain Crown lands in the District of Stellenbosch, at the Kuils River Outspan on the 13th January, 1926. (G.N. No. 1789.)

1515 27/11/25 Certain lots at Blaauwberg Strand, Cape, on the 25th January, 1926. (G.N. No. 2055.)

1515 27/11/25 Lot F, at Punzana, in the Division of Kingwilliamstown, Cape, at the Magistrate's Court on the 13th February, 1926. (G.N. No. 2056.)

1515 27/11/25 The land named Lot Prospect of the Ekelenburg Estate, situate at Rondebosch, Cape, at Rondebosch on the 13th January, 1926. (G.N. No. 2084.)

1513 13/11/25 *Live Stock.*—Regulations in regard to the introduction of sheep and goats into the Union from the Bechuanaland Protectorate are scheduled in G.N. No. 2000.

1514 20/11/25 *Export of Fruit.*—Additional regulations with regard to the export of fruit are scheduled in G.N. No. 2045.

1515 27/11/25 *Protected Areas.*—For purposes of the Scab Regulations, the following districts have been declared protected areas: Paarl, Cape Province (G.N. No. 2068); Vereeniging, Transvaal (G.N. No. 2075).

RECENT AGRICULTURAL LITERATURE.

SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

(NOTE.—The first number is that of the class to which the book belongs; the last number is that of the book itself.)

GENERAL.

017 Bishop, W. W. Practical Handbook of Modern Library Cataloging. Williams & Wilkins Co., Baltimore, 1924. No. 9109.

290,68 Bruwer, A. J. Protection in South Africa. Pro Ecclesia Printing Works, Stellenbosch, 1923. No. 9162.

AGRICULTURE, LIVE STOCK, AND ALLIED SUBJECTS.

411 Geldenhuys, F. E. Landbouonderwys deur die Skool. Nasionale Pers, Beperk, Bloemfontein, 1925. No. 9192.

430 Bakker, D. L. Grondbeginselen der Algemeene Veeteelt. W. E. J. Tjeenk Willink, Zwolle, 1922. No. 9011.

430 Hansen, J. Puschs Lehrbuch der Allgemeinen Tierzucht. Ferdinand Enke, Stuttgart, 1922. No. 9094.

430 Kroes, H. A. Huisdierenteelt. Erven B. van der Kamp, Groningen. No. 9093.
- Deel I. Ontleedkunde en Leer der Levensverrichtingen der Huisdieren met betrekking tot Hunne Teelt. 1917.
- Deel II. Uitwendige Kennis (exterieur) der Huisdieren (paard, rund, schaap, geit en varken). 1919.
- Deel III. 1. Algemeene Huisdierenteelt.
  2. Bijzondere Huisdierenteelt: (a) Het Paard, (b) het Rund, (c) het Schaap, (d) de Geit, (e) het Varken. 1921.
- Deel IV. (a) Bodem en Stal, (b) Wenken op het Gebied der Verloskunde, (c) Hoefbeslag, (d) Veeartsenijkundig Staatstoezicht, (e) Besmettelijke Veeziekten, Koopvernietigende Gebreken en Arbitrage en (f) (door W. Bakker) De Beginselen van de Voedingsleer en de Voeding der Landbouwhuisdieren. 1921.

430 Kronacher, C. Allgemeine Tierzucht. Parts 1, 2, 3, and 5. Paul Parey, Berlin, 1921, 1924, 1922, 1922. No. 9086.

430.4 Jacques, H. P. Modern Pig Farming. Cassell & Co., London. No. 9221.

431 International Institute of Agriculture, Rome. Dairy Cow Testing in Different Countries. 1925. No. 9222.

442,68X443,68 Cooper & Nephews, Ltd., William. Diseases and Pests affecting Sheep and Goats in South Africa with Methods of Treatment (4th Edition, Revised). William Cooper & Nephews, Ltd. Head Office: Berkhamsted, England. S.A. Branch: P.O. Box 4557, Johannesburg. No. 9194.

465,42 Empire Cotton Growing Corporation. Reports received from Experiment Stations for the Seasons 1923, 1924, and 1925 (South Africa only). London, 1925. No. 9223.

465,42 Farmer, J. B., and Killby, L. G. A Cotton Research Station for the British Empire, being a Summary of a Report to the Empire Cotton Growing Corporation. London, 1925.

471,68 Perkins, L. Practical Vegetable Growing in South Africa. Central News Agency, Ltd., Johannesburg, 1922. No. 9205.

474,68 Kightley, W. J. Chrysanthemums and Dahlias: How to Grow them and how to Show them in South Africa. The Specialty Press of South Africa, Ltd., Johannesburg and Capetown, 1921. No. 9204.

474,68 Murray, A. G. Carnation Growing in South Africa. The Specialty Press of South Africa, Ltd., Johannesburg and Capetown, 1922. No. 9206.

CHEMISTRY.

544.1 Spielmann, P. E. The Constituents of Coal Tar. Longmans, Green & Co., London, 1924. No. 9116.

544.1,66 Barnes, A. C. Chemical Investigations into the Products of the Oil Palm. Special Bulletin of the Agricultural Department, Nigeria. No. 9091.

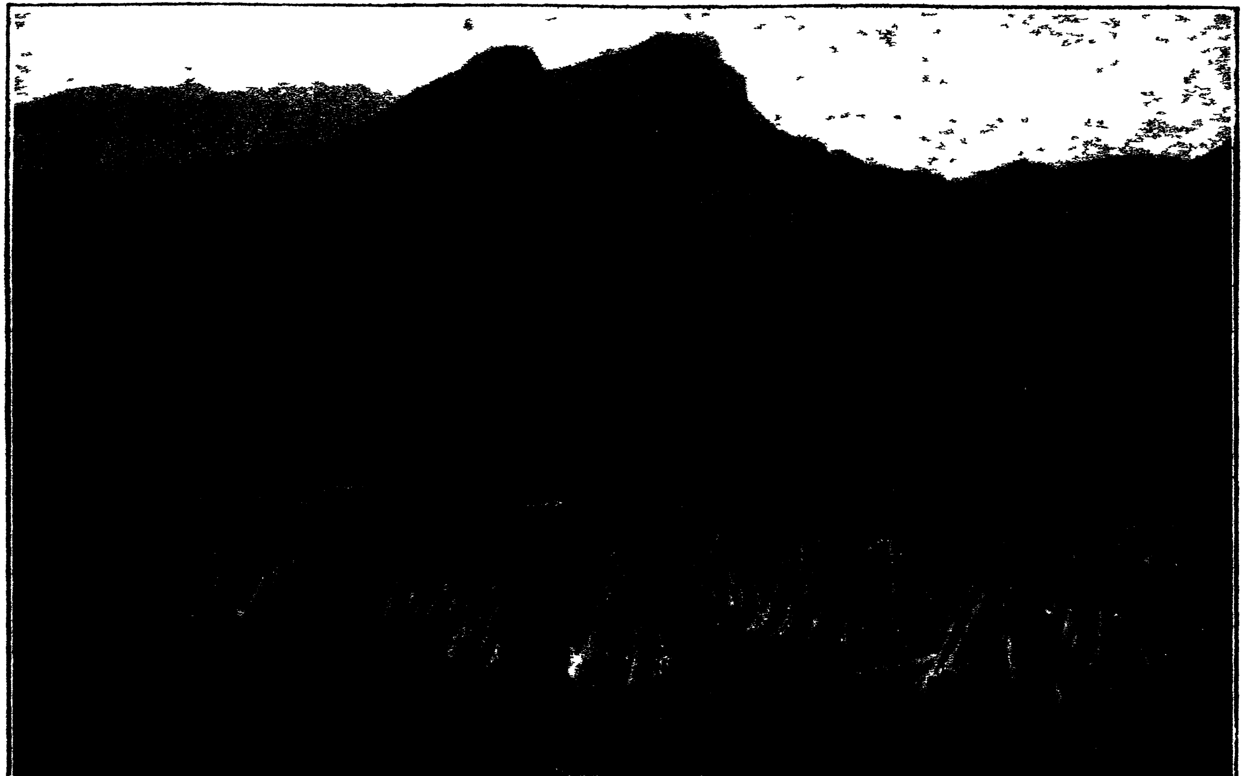
ENTOMOLOGY, BOTANY.

635.2,62X462,62 Willcocks, F. C. The Insect and Related Pests of Egypt. Volume II. Insects and Mites Feeding on Gramineous Crops and Products in the Field, Granary, and Mill. Sultanic Agricultural Society, Technical Section, Cairo, 1925. No. 9277.

671.7,68 Bews, J. W. Plant Forms and their Evolution in South Africa. Longmans, Green & Co., 1925. No. 9282.

671.82 Löhnis, Marie P. Onderzoek naar het verband tusschen de Weersgesteldheid en de Aardappelziekte (*Phytophthora infestans*) en naar de Eigenschappen, die de Vatbaarheid der Knollen voor deze ziekte bepalen (Mededeeling van de Wetenschappelijke Commissie voor Advies en Onderzoek in het Belang van de Volkswelvaart en Weerbaarheid). No. 9193.

675,94 Commonwealth Prickly Pear Board. The Prickly Pears Acclimatised in Australia. Sydney, 1925. No. 9273.



HARVEST IN THE HEX RIVER VALLEY

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NOTES.

Visit of British Farmers to South Africa.

By the time this issue of the *Journal* appears, much more will be known about the visit of the British farmers to South Africa.

It is a matter of pride to South Africa that she was the first to initiate a tour of this kind, which, when extended in the future, might prove to be of invaluable benefit to the farming community in South Africa generally.

Last year a party of South African farmers visited Great Britain and one or two countries on the Continent, and while it must be admitted that agricultural and climatic conditions there are vastly different from those obtaining in South Africa, we must confess that our farmers came back all the wiser and exceedingly satisfied with what they saw about farming and marketing methods, and the requirements of the trade as to the make-up and grading of our fruit, wool, etc., for the oversea market.

Some one hundred British farmers will shortly pay us a return visit. We wish to express our earnest hope that these visits will prove so beneficial to both sides that there will be a mutual desire to make these farmers' tours a permanent institution.

The South African National Union, under whose auspices this tour will take place, has, in collaboration with the officers of this Department and members of the S.A. Agricultural Union, worked out an itinerary which will enable our visitors to see a large part of the country before they leave our shores on the 30th April.

A suggestion has also been made that a party of farmers from the Netherlands should be included in the tour; and the High Commissioner and the London Committee of the National Union have the matter in hand. At the time of writing, however, nothing definite was known whether representatives from the Netherlands would be able to join the tour.

When our visitors arrive in South Africa on the 22nd of February they will find the south-western districts of the Cape Province in the full glory of the deciduous season, and the fact that South Africa is the only country which can supply Europe with fresh fruit during a great portion of the winter season will be more than ever emphasized; they will see the activities of our fruit-growers in catering for the European market, and will be impressed by the vast possibilities of those districts for fruit farming.

In the eastern districts of this Province they will come across promising dairy industries, but more than anything else, the eminent position of the merino industry in the Midlands, with its incomparable Karroo, will prove to them that South Africa is well on the way to become one of the principal countries for supplying the wool trade of Europe with the best grades of wool.

In the Orange Free State, which relies chiefly on agriculture for its prosperity, they will pass through the principal maize producing belt of the Union. This Province is also excellent for merino sheep farming, and as for quality and quantity of wool, it closely follows the Cape Province.

In Natal, the garden Province of the Union, where agriculture is more or less intensive, sugar and wattle bark are the staple products. This Province also has good prospects for cotton cultivation and which has been greatly encouraged during the last few years by Government experts working in conjunction with the Empire Cotton Growing Corporation.

The Transvaal, the land of many golden dreams, will appeal to them in many ways: On the Rand they will visualize the Mecca of the world's gold source; but more than anything else they will come to the disillusion that, however pre-eminently the Transvaal stands out as the mineral producing area of the world—nearly all the known minerals and precious stones occur there—this Province has already gone a long way in its farming development. Here they will find the principal home of the orange, the fruit that reaches Europe in autumn, when supplies from other countries are not forthcoming.

Our visitors will travel something like 7,000 miles during the sixty-eight days of their tour through South Africa, of which fifty-two days will be spent in the Union. We do not expect that they will learn anything from our farming methods, as our country is still young in years and experience, but we are quite sure that they will be deeply impressed by its charm and farming possibilities; they will have ample opportunities of seeing what the Department of Agriculture is doing for the farmer by way of assisting in organization, education, and dissemination of general information in regard to agricultural matters; they will come to realize that South Africa is rapidly assuming its place as an exporting country to the old world.

We herewith extend a hearty welcome to these visitors to our sunny South Africa and can assure them that their visit will be appreciated by all sections of the community, especially the farmers. We trust that they will enjoy their short stay in our country and will return to England fully satisfied. May we hope that this tour will merely be the forerunner of many more!

Dynamometer Tests.

For the plough designer, the plough manufacturer, and the agriculturist it is of great importance to know: (*a*) What is the draft of different ploughs of the same type, and of different types such as the mould-board and the disc-plough; (*b*) how great the resistance is (per square inch of furrow-slice) of different types of soil; and (*c*) at what horse-power the oxen work while ploughing.

Dr. W. S. H. Cleghorne, Mechanical Engineer at the Potchefstroom School of Agriculture, who set about to obtain an answer to the above-mentioned questions, attached a Watson self-recording draw-bar dynamometer to the different ploughs he used in his trials.

The results of the first three sets of trials were published in the March, 1924, issue of the *Journal*, and in short they were:—

1. That the mean pull per square inch of furrow-slice with mould-board ploughs was: Plough A, 9.3 lb.; plough B, 8.5 lb.; and plough C, 10.1 lb. Further, that the resistance of the heavier soil tested was 11.5 lb. per square inch of furrow-slice and of the lighter soil 7.2 lb. per square inch of furrow slice. In the heavier soil, the mean ploughing speed was 1.78 mile per hour and the mean pull per ox was 163 lb., so that the mean horse-power per ox in heavy soil was 0.77.

2. The next set of trials proved that a three-furrow disc-plough, the "Defiance," was heavier to work in clingy loam soil than a two-furrow mould-board plough, the "Prince," for the mean pull per square inch of the furrow-slice of the former was 7.34 lb. and of the latter 6.13 lb.

3. The third set of trials showed again that the mean pull per square inch of the furrow-slice of the two-furrow "Prince" mould-board plough in old mealie lands was 6.36 lb., while that of a three-furrow "All Conqueror" disc-plough was 8.84 lb.; thus the draft of the mould-board plough was 28 per cent. less than that of the disc-plough. The soil was dry and hard, and though the draft of the disc-plough was so much greater than that of the mould-board plough, still the former did much better work in pulverizing the soil.

In this issue of our *Journal*, the results are published of a fourth set of trials, and they are briefly:—

- (*a*) That the disc-plough has a much heavier draft than the mould-board plough even though, on account of the condition of the soil, the disc-plough ran shallower.
- (*b*) That the draft increases or decreases according to the moisture-content and clinginess of the soil.
- (*c*) The tests carried out thus far show that the manurial treatment of soils does not seem to affect the draft.
- (*d*) The use of coulters increased the draft per square inch of furrow-slice, e.g. without coulters it was 13.76 lb. and with coulters 15.24 lb., or an increase of 10.75 per cent.
- (*e*) The compaction of the soil affects the draft to the extent of making comparatively "light" soil very heavy to plough.

DEPARTMENTAL ACTIVITIES.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview month by month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him.—EDITOR.)

THE DIVISIONS.

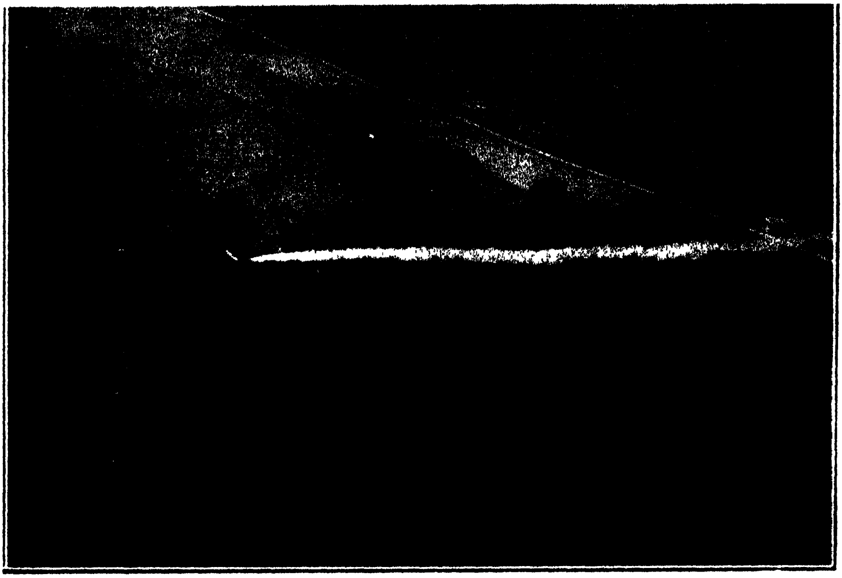
ENTOMOLOGY.

A Native Plant-bug Attacking Fruit.—In various parts of the Cape Province a common native plant-bug, *Lygaeus militaris* F., has been reported attacking fruit. In his report for November the Eastern Province Entomologist at Port Elizabeth states that apricots near Bathurst and peaches at Longkloof were severely attacked, but that in every case the fruit attacked was infested by maggots of the common fruit-fly, *Ceratitis capitata* Wd.

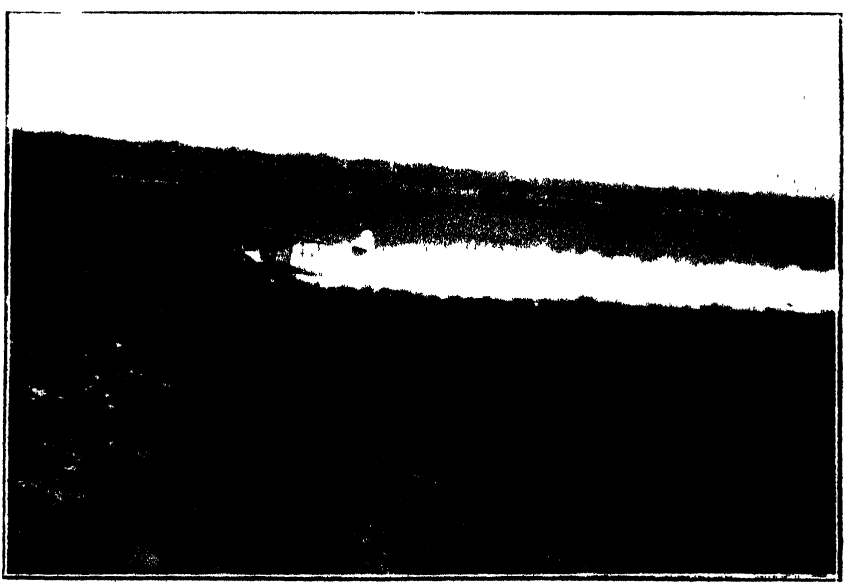
Another Introduced Weevil.—A weevil that was discovered feeding on eucalyptus trees on the Rand has been determined by the Imperial Bureau of Entomology as *Pantomorus godmani* Crotch. The Bureau states that the insect was previously named *Aramigus fulleri* Horn, and is known in the United States as Fuller's rose beetle. It is recorded as attacking roses and citrus. It is quite impossible to say how or when the insect was introduced into South Africa.

Pumpkin-flies Attacking Tomatoes.—Mr. L. S. Hulley, of the farm Stentor, near Kaapmuiden, in the eastern Transvaal, submitted two tomatoes infested with maggots. When the adult flies emerged they were found to be one of the large pumpkin-flies. *Tridacus pectoralis* (Walk.), a species which has been found to attack pawpaws as well in the same locality. Mr. Hulley states that tomatoes are more infested some years than others, and that the female flies lay their eggs while the tomatoes are still green. Over sixty flies were reared from the two tomatoes sent in.

Aeroplanes for Combating Insects.—At the request of the Department of Agriculture, the Air Services section of the Defence Department has equipped a " De Haviland 9 " aeroplane with a dust-dropping apparatus similar to that developed by the United States Department of Agriculture. At the time of writing, the apparatus is being tested, and before this note is published it is expected that the aeroplane will have been used to apply calcium arsenate dust experimentally to several large blocks of eucalyptus trees near Johannesburg for the destruction of the snout-beetle. The design for the apparatus was secured by Entomologist M. C. Mossop, who for the purpose visited



(*Photo by U.S.A. Dept. Agr.*)
Aeroplane spreading poison dust over a woodland in America.



(*Photo by U.S A. Dept. Agr.*)
Huff-Daland aeroplane, spreading calcium arsenate dust over a cotton field.

Tallulah, Louisiana, where the American Bureau of Entomology has for several years been conducting experiments in dusting fields of cotton for the destruction of boll weevil. Mr. Mossop, during the war, was an aeroplane pilot in East Africa. He has now joined the Division of Entomology and will be associated with the projected dusting of eucalyptus plantations. The Huff-Daland Company, American manufacturers of aeroplanes, has worked with the United States Bureau of Entomology in some of its experiments, and in the past season has engaged commercially in dusting cotton fields and fruit orchards. The company has developed a special type of aeroplane for the service, and Mr. Mossop learned that it had taken contracts for the treatment of about 50,000 acres of cotton. Sixteen special aeroplanes were employed on this private work. The company is reported to be well satisfied with its first season's operations and to be planning for far larger business in the coming season.

Borer in "Pinus longifolia."—During December, 1925, about thirty among the many thousands of two-year-old trees of *Pinus longifolia* at the Berlin plantation, near Godwan River, Transvaal, were found dying from insect attack. These trees were widely scattered through four compartments and all were destroyed except one, in which, unfortunately, the larva was crushed. A further examination of the plantation failed to reveal any more obviously affected trees. It is presumed that the culprit is a native *Cerambycid* which probably breeds in the natural forests of the nearby kloofs.

Eucalyptus Snout-beetle.—Up to the beginning of the year the eucalyptus snout-beetle did not appear to be present in as great numbers as in last February and March in certain large plantations in the Witwatersrand area. It is, however, feared that as summer advances the infestation will become even more intense than last year. No natural enemies of material importance have been discovered either at the Cape, or in the Transvaal, or Natal. The insect is spreading rapidly and no part of South Africa where eucalypts grow can be considered safe from it. During the past month various plantations near Pinedene and Irene, eight to twelve miles south of Pretoria, were found to be much infested. No discovery of the insect has yet been made north of Pretoria. The occurrence of the insect is still more or less sporadic; plantations of *viminalis*, the most attacked kind of eucalyptus, on different parts of the same farm are commonly being infested to a very uneven extent; but this irregularity of distribution is probably chiefly due to mere chance and not to any factor of a permanent nature. It seems clear, however, that trees growing under adverse conditions suffer relatively more than trees growing under favourable conditions. The planting of *viminalis* as a plantation tree appears to be wholly inadvisable pending the advent of some patent check on the insect. The wisdom of continuing to plant *globulus* and *maideni* for timber or mine props is also gravely questioned, as it seems probable that the insect will prevent their satisfactory development if not destroy them. Fortunately, the evidence so far accumulated in regard to *saligna* points to this valuable species as one that is little liable to serious damage by the insect. Entomologist F. G. C. Tooke continues to give practically all his time to studies on the insect. After recent close observations

on infested plantations in the Transvaal and Natal, he compiled the following grouping of the species that came under his notice:—

1. Very badly attacked: *viminalis, globulus, maideni.*
2. Badly attacked: *amplifolia, tereticornis, rostrata.*
3. Much attacked: *coriacea, propinqua, robusta, rudis.*
4. Slightly attacked: *hemiphloia, leucoxylon, obliqua, paniculata, saligna, siderophloia, sideroxylon, stuartiana.*
5. Not attacked: *amygdalina, botryoides, cladocalyx, eugenioides, gunnii, maculata, meliodara, pilularis, regnans, resinifera, sieberiana.*

Some of the species in the "not attacked" group have previously been recorded to be at least slightly attacked at Tokai, and hence will probably be found to suffer to some extent in the Transvaal and Natal. It is also probable that as time goes on the judgment on species listed under groups 2, 3, and 4 will be altered. At Tokai, *punctata* is ranked as "very badly attacked" and *urnigera* as "badly attacked." The eucalypt hitherto known as *saligna* in South Africa has been found by the Forest Department to comprise more than one species; and owing to the great importance in the northern Transvaal of a so-called *saligna*, young trees of the species have been procured through the kindness of the mining "Co-operative Exchange Yard" and will be used in feeding-tests.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

POTCHEFSTROOM, TRANSVAAL.

Diploma and Prize Distribution.—The diplomas and prizes were distributed on the 19th December, 1925, by Col. H. S. du Toit, Chief of the Division of Agricultural Education and Extension, who congratulated and spoke encouragingly to the young men who had been successful in gaining diplomas.

The year 1925 was a decidedly successful one from the point of view of the students' work; a very high standard of efficiency was set and maintained by the second-year class, six men being successful in gaining first class diplomas, three of whom also gained distinction in both Animal and Field Husbandry; the remaining three gaining distinction in Field Husbandry only. This constitutes a record, for in no previous years has more than one first class diploma been awarded.

In addition to the six first class, twenty second class diplomas were awarded, and one student failed to pass his examinations. The requirements of first and second class diplomas are:—

	Major Subjects.	Minor Subjects.	Aggregate.
	Per cent.	Per cent.	Per cent.
First Class	75	60	65
Second Class	60	40	50

Honours are awarded to students gaining 80 per cent. in either one or both of the major subjects (Animal and Field Husbandry), and are only awarded to holders of first class diplomas.

Forty-four first-year students sat for their Part I examinations; of these, seven failed to pass and were not permitted to continue Part II of the course; while eleven failed in one or two subjects only and will be allowed to continue the course subject to their successfully passing re-examinations in the subjects in which they have failed before a set date.

On the whole, the first-year class is somewhat disappointing, though there are a number of outstanding men who should do very well indeed as second year's.

Winter-ploughing as a remedy against Cutworms.—Winter-ploughing cannot be recommended for all climates and localities in the Union, but it should, wherever possible and practicable, be more generally practised than is the case at present.

The controlling and combating of the cutworm evil is undoubtedly the most important of the numerous advantages to be gained by ploughing in winter; for, without fear of contradiction, it can be safely stated that this insect pest has wrought greater havoc to the maize crop this season than ever before in the history of South Africa, and the damage that has been done must run into millions of pounds. Everywhere farmers had to replant, and even the second and third plantings have been destroyed in a great many cases. All this damage, however, only occurred on spring-ploughed land, while maize planted on winter-ploughed land was practically free from cutworms. This fact would seem to point out the remedy, but, unfortunately, there are some practical difficulties in the way of winter-ploughing which will have to be overcome or otherwise maize growing will have to be abandoned. Some farmers, for instance, claim that they would have ploughed their lands in winter were it not that they required all their trek animals to transport last year's record maize crop to the railway; others, again, maintain that if they plough their lands in winter, they would have no grazing left for their stock, as they are absolutely dependent on the maize-stalks for their winter feed.

For those who have transport difficulties, the obvious thing to do would be to follow the example of the American farmer and send their maize to the market on "four legs." This practice, if adopted, would not only prove more profitable than selling maize off the farm, but it would also make for a better system of farming. Those who are dependent on the maize-stalks for winter feed should either make provision by growing other feeding stuffs, or a better plan still would be to cut off the maize when the grains have turned hard, and in that way save the stover and clear the lands for winter-ploughing. It is realized that under present labour difficulties it is impossible to do this with large acreages of maize, but the farmer should attempt it at least on a portion of his lands.

Rotation of crops, discing old maize lands very early in spring, thereby destroying all green weed growth, and stretching the time between ploughing and planting to at least a month in order to starve the worms, are all measures that would assist materially in keeping down the cutworm pest.

Plough your Maize Lands in Winter.—There appears to be a general outcry from maize growers this season against the extensive damage done by cutworms and stalkborers, especially the former. Many growers state that they have had to replant on quite an extensive scale, some more than once. Almost unanimously they blame cutworms.

Undoubtedly cutworms have been unusually bad, but there is every reason for this. Last season the rains continued into the winter; this delayed harvesting and consequently winter-ploughing and the treatment of the soil to obtain a good tilth when the time for planting the present crop arrived. This greatly assisted the cutworms which depend upon the weeds in the lands for their food supply before the appearance of the young maize.

Maize growers, however, can control cutworms to a very considerable extent by making the interval between ploughing and planting as long as possible. The ideal is autumn-ploughing with sufficient harrowing thereafter to keep the lands free from weeds. This point cannot be emphasized too much. Wherever farmers have ploughed during the winter, and got their lands into such a state as to retain all the moisture possible from the light rains that have fallen this season, they have a good stand of maize. A concrete example is this institution. Many farmers in the neighbourhood have remarked upon the fine stand of maize in the experimental plots and farm fields as compared with their own maize lands. Loss, due to cutworms, was almost nil, and this is due to winter-ploughing and good treatment of the soil.

Cutworms are not the only insects controlled by winter-ploughing, but also the stalkborer and many other insects which attack maize can be effectively controlled by this means as far as our present knowledge goes.

It should, however, be mentioned that much of the loss laid at the door of the cutworms this season was not due to insects at all. In many districts the rains were late and light, and many growers followed the plough with the planter, and gave the soil but little preparation in the way of rolling and harrowing. Much maize consequently failed to germinate when planted; some instances came under our personal observation where lands have been replanted twice with but little success, whereas lands situated within a hundred yards and which were carefully prepared had a good stand of maize. Cutworms were blamed for the failures in these cases, and the owner of these particular lands is so firmly convinced of this that nothing will persuade him that they have little or nothing to do with the failure, although he cannot account for the normal stand on his neighbour's lands separated from his merely by a fence.

Maize growers are again urged to realize the importance of winter-ploughing.

GROOTFONTEIN, MIDDELBURG (CAPE).

New Silo Designs.—In connexion with the large bulletin on Silos, which is now being compiled by the Director of Field and Animal Husbandry, the Engineering Section at the Grootfontein School of Agriculture has designed several types of silos, both square

and circular, all built of brick. It was felt that the ordinary farmer who wishes to build a silo would find it very difficult and expensive to build in concrete, and to get a set of forms to cast the concrete in. On the other hand almost any intelligent farmer would be able to build in brick. Silos have now been designed to be built in brick, reinforced with galvanized steel fencing wire in the horizontal mortar joints. The brick silo has been calculated to cost from 15s. to £1 per ton capacity, which is considerably less than the cost of a reinforced concrete silo.

Wire Tests.—In connexion with the design of the brick silos, it was necessary to calculate the amount of reinforcing wire required in the wall of the silo, and for the purpose of knowing the tensile strength of fencing wire of different kinds, the Engineering Section built a testing machine, with which it is possible to put a sample of wire under a tensile stress, and measuring besides the tension in the wire during the test also the elongation of the wire. To measure the elongation an extensometer was built, which measures the stretch of the wire to one-thousanth of an inch. Three kinds of wire were tested, viz., ordinary plain No. 8 gauge galvanized iron fencing wire, plain No. 10 galvanized steel fencing wire, and oval section No. 12 by 14 gauge galvanized high strain steel fencing wire. The results of the tests show that yield commences in the No. 8 wire at about 500 pounds load, in the No. 10 wire at about 700 pounds, and in the No. 12 by 14 wire at about 1,000 pounds load. The No. 8 wire broke under a load of 1,100 pounds, No. 10 broke under a load of 1,295 pounds, and the No. 12 by 14 broke under a load of 1,440 pounds. The total elongation of the wires (all test pieces being 24 inches long before the test) was for the No. 8 iron wire, from 2.35 to 2.90 inches (different samples); for the No. 10 steel fencing wire 0.40 inch; for the No. 12 by 14 oval section steel wire, from 0.64 to 0.70 inch (different samples). So far the tests have proved the superiority of steel wires over iron wire for fencing purposes.

It is proposed to continue the tests with No. 6 iron wire, No. 7 iron wire, and different kinds of barbed wire. The testing machine will accomodate all these wires.

Dressing for Sheep Maggots.—In an attempt to discover a suitable dressing for sheep that have been attacked by sheep maggot-flies, and that are infested with maggots, a large number of substances, including the common commercial dips, have been tested for their maggot-killing properties.

Mixtures of those substances that have been proved most deadly to maggots, with the best known fly-repellants—such as whale oil, pine-tar, and naphthaline—are now being tried as dressings on sheep.

Batches of twenty sheep each, treated with the various mixtures, are being run together with suitable check batches on our worst veld for blow-flies. These sheep are not shorn or kept clean in any way, except that each month they are swabbed round the tail with experimental dressings. Careful records are kept of those animals that get blown.

This series of experiments may run for a number of years, as it will be some considerable time before any definite conclusions can be safely drawn from them. It is hoped, in time, to devise a dressing that will (*a*) kill maggots immediately it touches them, (*b*) heal any wound or irritation they have produced, (*c*) repel the flies and so prevent them from again blowing the sheep.

Soaking Seed for Planting.—On the 23rd October, 1925, some seeds of the Prosopis (Mesquite) were sown. One lot was untreated and the other lot had boiling water poured over it and allowed to soak in the water for thirty-six hours. In both cases the seed had been entirely cleaned from the sticky portions of the pods. Some of the seed was sown in the open ground in nursery beds and some in half paraffin-tins. The first seedlings started to appear above the ground ten days later. By the 25th October about 50 per cent. of the seed had germinated, and there appeared practically no difference in the time taken for germination between the soaked and unsoaked seed. Up to that time the number of seedlings obtained in both cases was practically the same.

The Red Poll Herd.—The following particulars of the Red Polls recently imported from England will be of interest to those interested in this breed:—

The cattle imported were selected from Suffolk, Norfolk, and Sussex herds. The five young cows and heifers from the Drinkstone herd of Mr. J. R. Hargreaves comprise stock fashioned on these lines:—

Drinkstone Tony, a four-year-old, which has yielded 9,493 lb., is sired by a bull out of the milk trials winner, Sudbourne Adela, which has reached nearly 12,000 lb. in a lactation.

Drinkstone Bounce III, a nearly four-year-old cow, which gave 700 gallons with her first calf, is out of a 1,400-gallon cow, her pedigree being studded with 800 and 900 gallon yielders.

Combs Petunia IV, another four-year-old, which gave close on 1,100 gallons with her first calf, belongs to a family which has average yields of 1,100 gallons.

Bredfield Dawn VIII, another four-year-old heifer, which has proved an 830-gallon yielder, originally belonged to Mr. J. H. Lachlan White, whose daily-kept records, extending over many years, show that butter from Red Poll milk can be made on the average at the rate of 1 lb. from 22 lb. of milk.

The other heifer from the Drinkstone herd, Drinkstone Pretty Jane III, has yielded 6,443½ lb. of milk in twenty-seven weeks, and up to 4 gallons a day with her second calf.

It is noteworthy that all the five Drinkstone animals are descended from the wonderful cow, Sudbourne Adela, now twelve years old, which with her last four calves has averaged over 10,000 lb. This cow was second in the London Dairy Show milking trials in 1915, third in 1920, and first in London Dairy Show milking trials, 1921.

The selection of four from the Mid-Norfolk herd of Mr. T. S. Matthews, one of the oldest Red Poll breeders, comprise truly dual animals, which not only have pedigrees tracing back to the foundation stock of the breed, but are descended from cows which—as the owner's carefully kept records show—are splendid examples of longevity, for which the Red Poll breed is noted. One of Mr. Matthews' heifers, Sporle Ribbon Rosette, a three-year-old, is out of a cow which has bred eleven calves, and which gave 8,747 lb. with her tenth. The butter-fat tests of the dams of these heifers average just on 4 per cent., while in the case of the dam of the three-year-old heifer, Sporle Excelsior, the butter-fat tests average for the last twelve months 4.8 per cent. in the mornings and 5 per cent. in the afternoons, one day's being up as high as 7.8 per cent. The four-year-old cow, Framlingham

Bell from M. W. Woodgate's herd, has a pedigree brimful of Royal and Dairy Show winners. Her dam was an 850-gallon cow, while her sire's dam, a 900-gallon cow, was a milking trials winner at the Royal, and no fewer than five times at the London Dairy Show. Mr. Woodgate's young bull, Royal Standard, just a two-year-old, is an excellent dual type of the breed, and he has a splendid record for milk in his breeding, his dam having averaged 9,952 lb. in the last four years.

The other consignors are Sir Merrik R. Burrell, Mr. H. Munro Cautley, and Messrs. Wrinch & Son. Mr. Munro Cautley's pair of heifers are Butley Coral, the daughter of Ickworth Mabel, a cow bred by Lord Bristol, who has an official average of milk for the last three years of 13,000 lb. Butley Emblem is the other heifer, which is a daughter of Henham Passion, the cow that has an average to her credit of over 10,000 lb. for the last five years. Both heifers are sired by Upton Rustler, which is decended from Acton Crowfoot, the bull which has greatly distinguished himself through his progeny at the London Dairy Shows. Sir Merrik Burrell's two heifers, typical of the dual animal, are both exceedingly well bred. Knepp Davy XI is a daughter of Knepp Davy III, which yielded 8,282 lb. with her first four calves, with an average of 3.9 per cent. butter-fat. Her sire, Sudbourne Ken, is a son of Sudbourne Credit, out of Sudbourne Flight, and she was first at the London Dairy Show, her yield in the year being over 12,000 lb.

CEDARA, NATAL.

A Successful Winter Pasture.—The South African farmer usually takes a great interest in the matter of permanent winter pastures.

A method of establishing a permanent pasture of Cocksfoot has been found to be very successful, under suitable conditions, in East Griqualand. The apparently necessary conditions are a good soil, free from weeds, a cool climate with a summer rainfall of at least 25 inches, and a fair amount of mist.

Good virgin redgrass veld is ploughed up in spring and thoroughly worked down so as to obtain a fine seed-bed by the end of February. Cocksfoot seed is then broadcasted at the rate of about 30 lb. per acre, lightly harrowed, or, preferably, rolled. Care should be taken to obtain seed capable of a high percentage germination, as much inferior seed is on the market. The pasture may afford a small amount of grazing the first winter if the season is favourable, but great care should be taken to avoid over-grazing the young pasture. The following February or March a crop of oats is usually drilled in; the mixed crop can either be used for grazing purposes in the winter or cut for hay in spring, or both. By the time the oat stubble has disappeared a complete stand of Cocksfoot should be obtained. The pasture is then spared in summer, taking only a crop of seed off it and grazed in winter. If care is taken to avoid over-grazing, the pasture should be of use for a number of years. Ten-year-old pastures were seen which still contained a fair percentage of Cocksfoot, although the native grasses such as umTsheeki and uViti were gradually dominating the Cocksfoot.

It is emphasized that the right conditions are necessary for success, and such conditions prevail only over small portions of the Union.

GLEN, ORANGE FREE STATE.

Poultry Farming: (1) *Moulting.*—February is essentially the moulting month and practically every bird will either have started, or be well in the moult. This is undoubtedly a trying time for the birds, and it is up to you to help them as much as possible. This can be done by paying particular attention to their feed. *To their dry mash add* a little flour of sulphur, say a tablespoonful to every ten or twelve birds, and the same quantity of linseed-meal-cake, ground fine; this will help considerably. An occasional feed of sunflower seed, once or twice a week, epsom salts, at least once a week, and as much green food as the birds will eat, will all help to bring them through a successful moult.

(2) *Selection of Breeders.*—February and March is the time to select breeders from the pullet flock. These are the birds which are just passing from their pullet year into their second season, and which have no individual trap-nest records of their laying. These can be selected fairly accurately in the following manner: All the birds which are well advanced in their moult should be cast aside. They are the "drones." The late moulters being invariably the best producers. The early moulter will stop laying and go into a moult, remaining in that state for probably a period of three months, and will not start laying any sooner than the late moulter. On the other hand, the latter will probably complete her moult within a month and start again with the former, which had a longer rest. Again the heavy producer has utilized a vast quantity of its heat, energy, and food material in producing the amount of eggs, consequently it is not in such a good condition to shed its feathers, nor does it moult as easily as the low producer. By this it can be seen that the last birds to moult are the first to be selected.

(3) *Attention to Young Stock.*—The young pullets which are to be used as the winter layers, should be very carefully handled and should receive considerable attention. By this time they should be in their permanent laying-houses. Watch carefully for egg-trouble and lice, etc., and do not be afraid to spend an hour or two at night to powder them with insect powder of some kind. *Chicken-pox* is usually prevalent during these months. A little sulphur given as stated above for moulting birds, will help to keep their blood cool, and will also help as a preventative. Watch for signs of roup, colds, and worms, and do not forget the epsom salts once every ten days. Give green food in abundance. Do not try to force them to lay, but give nature its own way. By now all surplus cockerels should be disposed of, and the few remaining good ones, which are kept for future use, should be given the best treatment.

(4) *For Exhibition.*—Birds intended for the show bench should have been selected, and to some extent partially treated, trained, and prepared for this purpose by now. Handle them frequently, kindly, and carefully, so as to get them tame and responsive to the judges' handling and stick. An occasional tit-bit in the way of fresh meat, bread, etc., will help greatly in this direction. Linseed meal, sunflower seed, or a little cod-liver oil, add lustre to the plumage. Heavy feathered varieties, which require long, soft, silky fluff and feathers to win, will improve their plumage, if fed on warm mash

daily. Game, and hard feathered birds should be supplied with beans, peas, and iron in their drinking water to get them in proper condition. White, buff, and other light coloured varieties, whose plumage is easily affected by the sun, should be kept in shady runs, and away from trees which are apt to stain the plumage if rain drops fall from them. Do not give this class any iron tonic, as it affects the light plumage. Attention should be given to legs, feet, and head-piece once a week. Keep the birds free from insects. If grain is buried in litter, it will improve their condition.

(5) *Runs.*—It is advisable to sprinkle unslaked lime over the runs as a top dressing. Dig it in, and plant with some quick growing crop, such as barley, sunflower, or mealies. This will have a tendency to freshen up the soil and at the same time will provide shade, green food, and scratching material for the birds when they are remated and put back into the runs in May.

(6) *Eggs.*—During February and the following two months, watch the markets carefully, and dispose of all preserved eggs. It is the scarce season, and eggs will be expensive.

(7) *Turkeys.*—Keep all the young birds on the move, either on the free range, lucerne lands, or crop lands (stubble), or have them herded daily in the veld. To warrant success, especially with young turkeys, it is essential that they should have freedom.

(8) *Ducks.*—As all young ducks should by now have reached the age of three months they should be sold, as it does not pay to keep them longer, except those intended for breeding purposes.

Cultivation of Maize.—Most farmers to-day realize the necessity for eradication of weeds on their lands, but there are still some who think there is no need for further cultivation. That this opinion is incorrect, except perhaps in the case of very light soils which do not form a surface crust, has been demonstrated in an experiment carried out here during the past four years. Certain plots were planted with maize kept free from weeds by means of hoeing in such a way that the soil was disturbed as little as possible, no soil mulch being formed on the surface. Other plots were cultivated between the rows four times during the season—from about three weeks after the maize came up until it flowered. A third series was cultivated six times, that is, on the same dates as those cultivated four times, and then on two occasions later, up to nearly a month after the tassels appeared. Any weeds on the cultivated plots which were not eradicated by the cultivator were hoed out afterwards. Plots receiving other treatment were also included in the experiment, the results of which are given below for the season 1924-25.

Treatment of Crop.	Average Yield of Maize in lb. per acre.	Increase over "Weeded" Plots.	
		lb.	Per Cent.
Cultivated six times	1,328	778	141
Cultivated four times	1,272	772	131
Harrowed and Cultivated	1,130	580	105
Harrowed only	900	350	64
Weeded by hand	550	—	—
No treatment	130	..	—

These results indicate that it pays handsomely to cultivate maize.

THE GREAT DROUGHT PROBLEM OF SOUTH AFRICA.

VIII.

The Light of Knowledge.

THE HARMFUL AND UNNECESSARY ROAD.

THE question of the country's roads is one that vitally concerns the whole community, and the Commission refers to the matter, particularly in its aspect as affecting soil erosion. Dongas and sloots often indicate where at some earlier date there was a road or right-of-way. The original bared track wears to a lower level than the neighbouring veld, catches up the rain falling on it or flowing into it, and begins to change its grade; or the road, now a canal, overflows. The usual result is that a sloot or donga forms along the greater part of the sloping road, and an impassable bed of loose sand or earth at the foot of the slope. The "road" sooner or later becomes so bad that it is abandoned. Very frequently the first abandonment takes place during a rainstorm, and usually the driver chooses the upper side in turning off the flooded road. Almost invariably subsequent travellers follow the same upper spoor, and soon a new track, lying above and parallel to the original "road," has been brought into use. Had the new track been below the old one, the latter at any rate would have served as a catch drain and so prolonged the life of the new track. But this rarely happens; instead, new parallel tracks are made one after the other, until frequently the area under them is hundreds of feet wide. Thus do unmade roads continuously destroy veld and deprive it of water. A well-made and well-maintained road would prevent this.

Even where roads are *made*, damage to surrounding property is often occasioned, for the roadmaker is faced with the problem of draining the roads and frequently of transferring water from one side of the road to the other. Not having the means to enable him to do otherwise, he ignores these requirements and pursues his course without thought of the damage done by the water running off the road. This trouble could be greatly minimized if the roads were fewer in number: with a reduced mileage the funds available for construction and maintenance would go further.

A ROAD POLICY.

The Commission considers the country's policy should be to reduce the mileage of roads to a minimum. But custom is slow to close a road. In the more level portions of the Union particularly, roads have been duplicated and multiplied beyond all reason. Yet it has been complained that the process of closing unnecessary roads is cumbersome, and that the law in this respect should be simplified.

It is realized that a certain stability must exist in the road-system of a district, and, moreover, that the system which has grown up and appears cumbersome to the layman is one based on sound reason and years of experience; yet where a small change in the law will lead to a great decrease in a very potent cause of donga formation, some such action would be justified. Therefore, it is recommended that the laws relating to roads be altered for a definite number of years so as to simplify the present procedure and permit of the easy closing of roads. Further, it is urged that no final sanction for the closing or deviation of a road be given until the road closed or deviated from has been properly protected from further scouring.

In the north-west Cape Province, it is mentioned, farmers who own no farm and pay no rent graze their stock along the trek-paths, raising large families the while. Bitter complaints have been made of these trek-paths, for the eradication of scab and the fencing and paddocking of farms are greatly hindered by their presence.

AGRICULTURAL EXPANSION THROUGH THE RAILWAY.

Agricultural development is very closely associated with railway development. Many things influence the direction of agricultural expansion in any locality, the question of the market being frequently the most important. In the neighbourhood of a large town or centre, milk production, cultivation of vegetables and similar perishable commodities are usually paying industries. In areas further distant from such centres, these commodities cannot be produced profitably. But railway development can largely remedy this by reducing the time occupied in transporting produce to market and so making possible the increased production of perishables in localities that would otherwise be too remote to grow them economically.

It is not only perishables, however, that are affected by railway development. The cost of a commodity reflects the cost of production plus the cost of transporting it to market. Thus, in competition, the deciding factor may be the cost of transport. There is a limit to the amount which may be paid for transportation, and consequently a limit to the distance from a market at which certain commodities may be profitably produced. Railways, by cheapening and facilitating transport, increase this maximum limit and thus expand the area in which such commodities may be economically raised.

Recognizing the great importance of railways in the country's agricultural development, the Commission advocates the closest co-operation between the Railway Administration and the Department of Agriculture in the discussion of railways proposed for dealing with commodities already being produced or for developing the potentialities of backward districts, as well as the question of railway rates which may often be adverse to the development of an industry. Then, also, the introduction of a new industry into the country may depend for ultimate success on a certain amount of initial nursing; for instance, in the adjustment of freight rates, as far as possible, by the Railway Department. Once such industry has been properly established there would result an increased volume of railway business which would more than repay the early assistance lent it.

There is also the question of reduction of rates for fodder and for stock when moved to escape droughts; these rates constitute an important service rendered by the railways in times of drought.

Mention is also made of the fact that railroads cause much soil erosion and the need for greater attention to this aspect of our railways.

Altogether, the Commission emphasizes the benefits that would follow close co-operation between the two departments, and is certain that such co-operation will be the means of reducing losses in times of drought.

THE AGRICULTURAL BIAS IN SCHOOLS.

The whole of the report bristles with examples of the necessity for the farmer to help if he wishes to escape or minimize drought losses. The State, too, has a duty in leading and encouraging the farmer; but the State cannot take the farmer by the hand day by day and prescribe what he must do. The farmer must act alone. Farming is the practical application of a large number of intricate natural sciences, and it is on the correct application of these sciences that the greatest success in production depends.

Unfortunately the bulk of the present generation of farmers had little schooling, and even the most elementary facts of science are unknown to them. In the absence, therefore, of any foundation of this nature, the practical farmer of to-day finds it difficult to realize thoroughly the object of all the methods that may be advocated by the expert or specialist.

For example: A man attends a lecture on dry-farming methods and hears, without proper understanding, the why and wherefore of deep ploughing, that such is often necessary in order to incorporate organic matter with lighter soils, not only to fertilize them, but also to increase their water-holding capacity. He returns to the farm with the idea that deep ploughing is the whole secret of dry-farming, having forgotten or not understanding that climatic and soil conditions, time of ploughing and sowing, proper and timely preparation of the seed-bed, water-holding capacity and natural fertility, drought or rust resistant varieties, time of maturity, etc., are also important factors. Had the farmer fully appreciated all of the principles underlying the system of dry-land farming, he would not merely have avoided many a crop failure, but would also have saved himself much time and trouble. Had he, in his school days, received instruction in the elementary principles of science, or had been given lessons in nature study, he would doubtless have been in a much better position to assimilate all that the dry-farming expert had told him.

Similar examples could be culled by the hundred from the experience of any agricultural expert in dealing with a certain type of farmer; and they would all point to the necessity for an agricultural bias in education, and for more attention to the simple facts of natural science.

As to the attainment of this end, many educational authorities were consulted, one of whom (in New Zealand) sums up the matter in the following paragraph:—

> "It cannot be said that any particular subjects have been dropped out of the primary school syllabus in order to make room for nature study, agriculture, etc. It is rather that the teachers have in recent years been given such freedom in the construction

of schemes of work for their schools as has enabled them to build their courses, where desirable, in such a way as to include naturally a treatment from the rural point of view of all the subjects of instruction which have a direct bearing on farmers' problems."

This question, of such importance to a country whose future depends on an expanding agricultural industry, is at present receiving the attention of educational investigators. One of the recommendations of the Committee on Agricultural Education, 1922, was: "While agriculture, as such, cannot be taught in rural primary schools, the course followed in such schools should be brought into closer touch with the pupil's environment, especially through the medium of nature study and, where possible, school gardens."

The matter, the Commission states, is largely technical and must be left to educational experts, but it urges that the courses of instruction followed, particularly in rural schools, should have a strong agricultural bias, seeing that so many scholars will, in later life, be directly or indirectly dependent on agriculture for their livelihood.

BRIDGING THE GAP OF UNENLIGHTENMENT.

It is now some considerable time since political economists first brought the following facts prominently to the notice of all civilized nations, viz.:—

(*a*) That the proper development and husbanding of the resources of the soil have a more immediate bearing upon life and living than most other human interests.

(*b*) That there is a world-need for increased production, since the difficulty of acquiring sufficient food is even now being experienced throughout the world.

(*c*) That the resources of the soil, in many parts of the world, are already failing to keep pace with the increase of the world's population.

(*d*) That the pressure of increase in the population of Europe was mostly balanced by the supply of food from the virgin soils of America.

(*e*) That a surplus of cereals for export from America is now available only when the harvest is very favourable.

(*f*) That Europe, hitherto dependent mainly on North America, Russia, and some of the Balkan States for her grain supply, is becoming more and more dependent on food supplies from South America, Australia, and South Africa.

(*g*) That South American supplies are being increasingly diverted to the United States and that, while South Africa is in a more favourable position to supply Europe than is Australia, it requires no prophet to fortell an approaching world-interest in our Sub-Continent such as that which was evinced last century in North America.

(*h*) That the main pre-occupation of South Africans should be, therefore, to put their house in order, to fit themselves to hold their own, and to profit by the fast-approaching turn of fortune's wheel, rather than be destroyed by it, as has been the fate of others who were in a similar position.

Bearing the above points in mind, and conscious of the experience of progressive countries that a knowledge of the principles of good farming should be disseminated widely throughout the farming world, the Commission expresses gratification at the creation of a Division of Extension in the Department of Agriculture. By means of its extension officers (based on the successful system of district agents now operating in the United States of America) and the agricultural demonstration train, the Division of Extension will perform the much-needed service of bringing the expert knowledge of the Department to the farmhouse door. It will thus be a powerful agency in dispelling the ignorance on matters of even elementary and fundamental agricultural practice that is all too prevalent, and so, among other benefits, do much to minimize the bad effects of recurrent droughts.

THE ORGANIZATION OF FARMERS.

Most of the difficulties of farmers are magnified by the lack of organization among them, which prevents them from working together with that perfect combination so necessary to their welfare.

Even where some degree of organization has been effected and a local farmers' association or agricultural society formed, there is frequently a lack of organization or cohesion between the different associations, and the united front which is essential to give weight to their resolutions or acts is wanting. Following on the trail of organization comes controlled markets, and, eventually, co-operation. Through lack of organization, a non-regulated supply of farm produce frequently leads to flooded markets, and a resulting slump in prices. Through lack of organization co-operation is delayed, and the wily speculator, playing the one producer against the other, takes the cream of the business.

The difficulties besetting the path leading to organization are numerous. The sparseness of population and the great distance which many farmers have to travel, prevent that regular attendance at meetings which is needed to keep up interest in the association. Personal envy and political enmity also tend to prevent smooth working, but a most potent factor is that lack of agricultural education among members—and this is even more pronounced among farmer non-members—which blinds them to their own interests; and as a result matters are too often judged by the farmer not from a farmer's, but from a party politician's point of view. It would be well if the farmer could put aside party politics when attempting to work for the general good of his brother farmers.

Such organization as has already been achieved has not been entirely satisfactory from the point of view of efficiency or economy. To obtain satisfaction in this direction, the system of organization should be more on the lines of organization which have been adopted by political parties. There should be, say, one farmers' association in every polling area outside the towns. Such associations would be affiliated under what might be called a district committee, whose headquarters would be in the principal town of the neighbourhood. As many districts as have identical agricultural interests would then combine and form a circle union or association, which in turn would be affiliated with the other circle organizations of its Province, forming the Provincial Union. The South African Agricultural Union would furnish the final bond, tying the whole organization together.

An organization constituted in this manner would permit of matters being properly thrashed out; each body would deal with such matters as it was competent to deal with, and the work done by the local bodies would do away with the necessity for central committees or congresses having to waste their time with purely local affairs. Not only would such an organization function as a channel from the farmer to the Government, by means of which farmers as a whole could speak with one voice to the authorities, but it would also be a channel for the dissemination of information, enabling the Government to speak once and yet be heard by tens of thousands of farmers.

Among the benefits to be derived by such organizations are:—

(1) The saving of the time and the expenses of office-bearers.

(2) The establishing of a body which is the formal representative of the farming profession and which can act as the mouth-piece of the farmer in corresponding with Government or with other organizations on any occasion whatsoever.

(3) The educating of the farmer in the control of his own affairs.

(4) The assisting of the Department of Agriculture in the dissemination of information, in combating stock diseases and locusts and in the eradication of scab.

(5) The controlling and regulating of markets.

(6) The establishing of local farmers' loan banks.

(7) The more economical purchasing of farming requisites.

(8) The arranging for the distribution of fodder and the apportioning of grazing during periods of drought.

It has often been argued that farmers should organize themselves, and this argument is theoretically quite sound; but it has proved a total failure in practice. Yet it is in the interest of the State and of the individual to have farmers organized. Organized farmers are easier to deal with as their wants and desires are more readily ascertained; moreover, the Department of Agriculture is greatly assisted by being able to treat with such organizations instead of with individuals. In short, an increased usefulness is obtained at decreased cost. In this manner the knowledge and experience of the expert can be put to more extended use, resulting in a higher standard of agriculture, while the organized farmer becomes more independent and self-reliant. By combining they gain in strength and eliminate the possibility of many malpractices to which the individual is now subject. Capital for the purpose of manufacturing raw materials is enticed into the country, and local prices are stiffened up; organization, indeed, resulting from the propaganda work carried out by the Commission in the course of its investigations, has already been successful in staying financial panics which would otherwise have resulted in bankruptcy to some.

It is a recommendation of the Commission, therefore, that the State should assist in bringing about the organization of the farming community.

THE FINAL SUMMARY.

In a final summary of the conditions disclosed in their report, the Commission sets out as follows the questions submitted to them for investigation and their findings thereon:—

(1) The methods by which losses to farmers owing to periodic droughts in the drier parts of the Union may be prevented either by public or private action; and in particular whether any changes in farming methods are necessary for this purpose.

The most pressing and necessary change in farming methods is the abolition of the usually practised kraaling of stock and its substitution by the paddocking system. Kraaling is detrimental to the veld as well as to stock; it leads to a diminished efficiency of rainfall which is a much greater menace than a decreased rainfall. Complete grazing control through an efficient system of paddocks should be the goal; but an efficient paddock system demands the provision of an adequate and pure water supply. The reduction of drought losses should lead to improvement in the breed of animals. Overstocking is bad farming. Farmers should accumulate fodder reserves for drought periods. Windbreaks and shade do much to assist in maintaining stock. It is calculated that the income of the Union from wool alone would be doubled if the paddock system were generally adopted, while if all phases of the small stock industry be taken into account, the annual increased return, capitalized at even 10 per cent., would very nearly equal the fixed property valuation of the Cape Province. There is room for much improvement in the economic use of water.

(2) Any improvement in farming conditions generally, such as the provision of more water, prevention of soil erosion, and any other matters which may have a close bearing on point (1).

The improvements outlined in the previous paragraph require the alteration of certain general conditions, to bring about which is beyond the powers of the individual farmer. For example, the jackal is responsible for much of the faulty small-stock farming, and he must be got under control or even be exterminated. The rapid adoption of the paddock system would be facilitated by making cheap fencing material available and by minor alterations in the fencing law. The farmer should be encouraged to develop the water resources of his farm. Stock thefts should be discouraged. The failure to realize the benefits that would accrue from the better method of farming is a reason preventing their adoption, an obstacle which educational effort would do much to remove. In this the organization of farmers would greatly assist, and for the achievement of this end, the State should detail suitable officers. Farmers' organizations will ease matters during droughts. Improvements of transport facilities and generally improved market facilities will greatly ameliorate the farming conditions. Drought losses could be diminished if reliable seasonal forecasts were possible: the Government should appoint a committee of experts to determine what steps should be taken to obtain such forecasts. The provision of cold storage and of factories for making meat products would assist in

the more economical use of the veld by enabling the farmer to dispose of his stock when in good condition. Deterioration of the vegetal cover and the resulting soil erosion are doing much damage and seem to be main causes of the decreasing European population in the Cape Midlands. The soil is an irreplaceable national asset. The State should, therefore, actively assume its responsibilities in connexion with the conservation thereof by appointing a reclamation officer. Veld burning as practised is detrimental to the country, but cannot be stopped by legislation. In most cases education will be the only deterrent; but your Commissioners consider that in certain areas of high value as catchments feeding irrigation works, the prohibition of grazing would lead to the cessation of veld fires. Evaporation plays a very important rôle in the social economy of the Union; probably many times the quantity of water which finds its way to the sea by rivers is lost in unproductive evaporation which would be reduced by the maintenance of an efficient vegetal cover, and, through that, the prevention of soil erosion. Irrigation, though definitely limited in extent by the run-off of rainfall, topography, soil and financial factors, will always be an important aid to crop-raising and stock-farming. Through deterioration of the vegetal cover and soil erosion, the efficiency of the catchments of most rivers used for irrigation is decreasing. The State should direct the preservation and reclamation of those catchments, which relatively and luckily are small. Since the silting up of dams is beyond the control of the irrigator, the State should assist, *inter alia*, by aiding farmers to paddock and by preventing soil erosion. Afforestation with suitable species for improving the head-waters of our rivers and their tributaries, and for other reasons, is to be recommended. The study of insect and other pests and of weeds which reduce the grazing yield should be undertaken by the State. The State should also make preparations to establish fodder banks.

(3) The methods by which indigency arising among the farming community in consequence of such losses could best be dealt with.

Drought and other causes work together in producing indigency. The general improvement of conditions will decrease poverty, which is most intense after droughts. Education and the improvement of transport and market facilities are needed. Climatic and genetic conditions should also be considered.

(4) The production of feeding by the cultivation of various grasses.

Usually farmers make no provision for droughts. They should do so by sparing veld, making hay, by growing fodder crops, including spineless cactus, and crops for making ensilage. They should also establish fodder banks. The Department of Agriculture should carry out certain investigations with reference to fodder plants.

CONCLUSION.

The foregoing is a brief summary of a memorable and outstanding publication. It presents a review of the main report only. This main report is supported by a valuable and unique collection of maps and charts, and forty-eight reports and statements giving in detail a

mass of data that help to enhance considerably the value of the publication. These appendices have not been included in the summary. They must be studied in detail by the student. The aim of this summary is to give the salient points of the main report and to convey, if possible, the spirit that breathes throughout its pages. It is published in the hope that its teachings will find their way to the hearts of our farmers, on whom the welfare of our country so largely depends; and particularly is it desired that the coming generation of farmers will be fired with the determination to acquire that knowledge whereby the evils disclosed by the Drought Investigation Commission of 1920 may be circumvented.

[NOTE.—For further details read Chapters XXX, XXXI, XXXIII, XXXV, and XXXVII of the Final Report of the Drought Investigation Commission.]

Asparagus Culture.

Asparagus is a good paying proposition in South Africa, but it is only in comparatively few places that it can be grown with success. The best soil is a good sandy loam. The main secret of success is to have well prepared trenches before planting. Make the beds from three to four feet wide with paths about two feet wide, this mainly to prevent walking on the beds and damaging the crowns. Dig the soil two feet deep, in the bottom spit turn as much well rotted stable manure as possible. Do the same to the top spit.

The plants should be raised from seed. Get a good variety, such as Connover's Colossal, and sow it fairly thickly in a tin. To get a quick germination, seed can be soaked for twenty-four hours. Asparagus seed is fairly slow in germinating, taking twenty to twenty-four days. Seed can be sown at different times. It can be sown as soon as it is taken from the plant, and the young plants can be ready for transplanting in autumn, or the seed can be sown in spring, either in tins or in the prepared beds.

When the young plants are about three or four inches high they can be transplanted into their permanent quarters. Plant the young plants to a foot apart each way. Very little attention is required except weeding for a couple of years. A light dusting of salt is considered helpful in winter time. Spread the salt on the surface and rake it in. When harvesting the third year, cut about one-third of the crop, the fourth year one-half, and the fifth year and onwards you can cut two-thirds.

It must be understood that when cutting the young shoots sufficient of them should be left evenly distributed over the bed to carry on the work of food elaboration or to assist in the storing up of the food material for next year's growth. After the plants are well established the cost of looking after asparagus is very small, and as a rule asparagus is sold at about 1s. per small bundle. It can thus be seen that this is a paying crop.—(*Glen School of Agriculture.*)

A BACTERIAL DISEASE IN WINE.

By F. FEVRIER, B.A., Assistant Government Viticulturist.

THAT wine undergoes a detrimental change by the action of bacteria is nothing new. Indeed, wine, which is a liquid of a very complex nature, offers an excellent medium for the growth of many micro-organisms. These "infinitely small beings" play an important part in the making and maturing of the wine. Some are beneficial, if not essential, others are distinctly harmful; and the cellarman must exercise all his skill in preventing their access into the wine.

Even the healthiest of grapes have on their surface, adhering to the bloom, myriads of organisms of different kinds. Here they are present in a form which is resistant to desiccation and other agencies which might destroy them. In this form they exist on the surface of the grapes, awaiting an opportunity to develop. This opportunity is afforded to them when the grapes are crushed and they are washed by the must into the fermenting tank. The well-known phenomenon of fermentation is caused by yeasts which are among the myriads of spores to be found on the grapes. This is but the first stage in the decomposition of the grape juice; if yeasts were the only organisms that develop in the sterile must, then the wine would be perfect. This, however, is never so, as other spores also multiply in conjunction with the yeasts and alter the composition of the normal wine, rendering it more or less sour or otherwise unfit for consumption.

UNWANTED ORGANISMS.

It is essential, therefore, from the outset to take every precaution to prevent the introduction of unwanted organisms.

In the first place, the grapes coming in from the vineyard must be well ripe and perfectly healthy. Bunches which have been lying on the ground and which may be mouldy are a sure source of infection, and must on no account be placed in contact with healthy grapes nor be pressed with them. Judicious selection at this stage of the grapes which are about to be turned into wine will go far to produce a clean fermentation and an acceptable product.

There are different strains of yeasts: the true wine yeast—the elliptic yeast—is the one which will give the best wine. This variety must be helped in every way by placing the fermenting must in conditions most suitable to its growth. This is done by "sulphuring" the must as soon as the grapes are crushed. Sulphuring is effected by the addition of potassium meta bisulphite ("meta") in measured amounts, and the SO_2 liberated in the liquid kills all the bad germs such as moulds, wild yeasts—the apiculate yeast, and acts as anaesthetic to the more resistant elliptic or true wine yeast. This delays fermentation, and allows the impurities contained in the must to settle in the bottom of the tank. Decantation can thus be effected: the sediment, which consists of earthy matter and germs,

is left behind to ferment for distilling purposes, while the clear decanted must, which is placed in a clean vat, is made to ferment immediately with a starter of pure yeasts in full activity.

After having taken all these precautions, one would expect the resulting wine to be of the best quality. Fermentation, however, requires careful observation; the temperature must not be allowed to go too high; cooling and pumping over must be carried out at the right time; and general attention is of paramount importance.

All this is done with a view to keeping the fermenting must in a condition most favourable to the life of the yeast so that at no time will their force be impaired or their activity slacken. When this happens, owing to excessively high temperature caused by fermentation, a chance is given to harmful bacteria to thrive in the young wine and soon to render it undrinkable. Where do these bacteria come from, is a natural inquiry. The answer is not easy to give. Probably they may have been introduced at the time of pressing, and even sulphuring did not kill them. It is possible that they were introduced during fermentation, by the use of dirty apparatus, or the vats themselves may have been the source of contamination.

A New Bacterium.

During the last 18-24 months I have examined through the microscope a large percentage of wines brought to me for analysis. These consisted of all types: red, white, sweet, and dry. In practically all types examined, bacteria were found in greater or smaller numbers. This particular kind had not been previcusly noticed, and are not unlike the bacteria which cause "Tourne" in French wines. They differ from the latter in that they do not seem to destroy the cream of tartar of the wine; and, unlike Tourne bacteria, they thrive in sweet wines fortified to 19 or 20 vol. per cent. (33-35 P.S.)

Red dry wines and red sweet wines have been more particularly observed and studied in connexion with these micro-organisms, and wines attacked by them have the following characteristics. A young Hermitage wine containing these bacteria has a dark, opaque colour, with a somewhat bluish tinge around the edges on the surface. If the disease is in its incipient stages, the taste of the wine is practically normal. A bitter astringent taste characterizes a wine in which the disease has established itself; such wines invariably have a high volatile acidity. It is impossible to remedy this, and a wine having gone thus far is unfit for human consumption.

In sweet wines the bitter taste, although masked to a large extent by the sugar, is easily noticeable, and it is not uncommon to come across red sweet Muscadel, or "Jeripico" made from Muscadel, having a light red colour, being turbid, with a bitter taste and a high volatile acidity. Such a wine contains large numbers of these bacteria.

All attempts at killing these bacteria have so far been unsuccessful. Heavy doses of SO_2 certainly attenuate their activity, but without fatal results. Such large amounts of SO_2 have a dertimental effect on the colour of red wines and, besides, make them practically undrinkable.

Alcohol also slackens their activity without killing them, as is the case in sweet fortified wines.

Pasteurization was tried on a small scale at a temperature of 80° C. on a sample which was badly infected, and although heating was repeated on three successive days, and for five minutes, these bacteria seemed unaffected except for a tendency to divide. All other germs, such as acetic bacteria, yeasts, etc., were effectively destroyed.

They are active throughout the year, though less so in cold than in warm weather. For this reason great care must be exercised by the farmer so that on the return of warm weather the cellar may be kept as cool as possible. All the vats need not necessarily contain these organisms so that a source of infection is obviously the inoculation of a healthy vat by adding wine from a diseased vat.

It is here that a good microscope is indispensable in order to ascertain the condition of the wine in each individual cask—be it even hogsheads—before beginning to rack. Casks found to be affected may be saved if they are not too far gone and if treated during winter while the activity of the bacteria is lowest. During the cold weather, then, such wines can be sulphured, and a couple of days after a fining will cause these germs to be brought to the bottom of the cask. After ten days to a fortnight the wine is carefully racked into a scrupulously clean receptacle, taking care not to disturb the sediment, which, if taken over, would only carry on the disease to the new cask. Should the fining have been unsuccessful, filtering may possibly bring about the two-fold requirement of clarification and of the elimination of bacteria. Filtering, however, should only be resorted to if the wine is not too far gone; the volatile acidity will serve as an indication in this respect.

Before racking, the sound wines in the cellar should be selected, handled first of all, and kept strictly apart from diseased wines. Casks having contained affected wines must be thoroughly washed out with caustic soda so as to eliminate the possibility of spores (?) or germs themselves remaining hidden in the crevices between the argol crystals and infecting a healthy wine next season.

SOURCE OF DISEASE.

Nothing can yet be said with any degree of certainty on this subject. The fact that all types of wines and wines from all regions are subject to this disease makes research difficult. Even wines fermented on a small scale in bottles in the laboratory show signs of infection. This would point to the fact that we must direct our investigations to the grape itself at the time of the vintage, and find out how this organism can be eliminated. "Prevention is better than cure," and in this case prevention is everything—the cure being in all probability impossible.

The disease is also transmitted by the use of cellar apparatus which has not been properly cleaned after having been used for infected wines.

Samples from all parts of the country would be welcome in order to obtain material at all stages of development which might be used for investigation.

ROLL TOBACCO.

The Industry in Oudtshoorn and Surrounding Districts.

By V. F. OLIVIER, B.Sc.Agr., Tobacco and Cotton Expert, Oudtshoorn, Cape Province.

TOBACCO has become the main cash agricultural product in these districts ever since the slump in the ostrich feather industry, and of the leaf produced in these areas about 60 per cent. is manufactured into roll tobacco.

As the roll industry is of considerable importance to this area, and as there is no literature treating with this industry, it seems propitious to briefly deal with this subject.

HISTORY.

Although the origin of tobacco growing in this district is hidden in obscurity, it is certain that tobacco was grown here as early as 1845. In those days there were no factories, and farmers manufactured their leaf into rolls, with which they traded in other parts of the country.

The first attempt to establish some sort of factory was made in 1882 by Alfred Agard Pocock, who established a small cut and roll tobacco factory in Oudtshoorn. About 1886 the Cango Tobacco Factory was established, with Mr. Pocock as secretary, and this was actually the first attempt to manufacture tobacco on a large scale in Oudtshoorn. This factory manufactured roll and cut tobaccos and also cigars, for which purpose cigarmakers from Holland were procured, and at one time cigar-making played an important part in the Oudtshoorn tobacco industry. The influence of cigar-making remains here, for there are still two or three firms in Oudtshoorn making cigars.

In spite of the establishment of factories, the bulk of the farmers continued to roll their tobacco and traded with this in other sections of the country. This method remained in vogue to a certain extent up to the imposition of the tobacco excise in 1920, and now that the tax has been abolished, there is no doubt that some farmers will again revert to manufacture and trade.

Since the establishment of the first one many factories have started, and these districts to-day register thirty-four factories with about 1,500 employees—including men, woman, and children—Europeans and coloured.

TYPES OF TOBACCO GROWN AND DEMANDED FOR THE ROLL TRADE.

The types of tobacco firmly established in the district (from the roll tobacco manufacturer's point of view) are Virginian types, locally known as "Regop" and "Blinkblaar." The origin of these tobaccos is not known, but it appears that the seed was originally procured from Amersfoort, in Holland. The influence of Holland and cigar-manufacturing are clearly seen, as the so-called "Blinkblaar" is identical to a "Sumatra" tobacco introduced by the writer in his variety tests. The "Regop," as its name indicates, is a tobacco with leaves growing straight up against the stem.

[*Photo. by V. F. Olivier.*

1.—Field of "Regop" Tobacco in Schoemanshoek, District Oudtshoorn.

GROWING AND CULTIVATION.

As this article deals only with the roll tobacco industry as such, the part of growing and cultivation will not be treated at length.

All the tobacco grown in this area is under irrigation, and the method of planting is similar to that in other parts of the country where tobacco is grown under irrigation, except that the distances between rows and plants are somewhat closer.

All the cultivation from the time of making the rows right up to the end is done by hand. There is, however, a tendency now to use cultivators.

Irrigation is done directly on the plants in the rows; here, also, there is a tendency on the part of some farmers to depart from the old methods and irrigate between the rows. As a general rule the growers are inclined to over-irrigate.

The operations of topping and suckering are similar to that practised everywhere, excepting that growers are disposed to leave too many leaves to the plant.

The bulk of the tobacco is inclined to be on the coarse side, due to the natural fertility of the soil and the practice of planting tobacco after legumes like lucerne, peas, and beans.

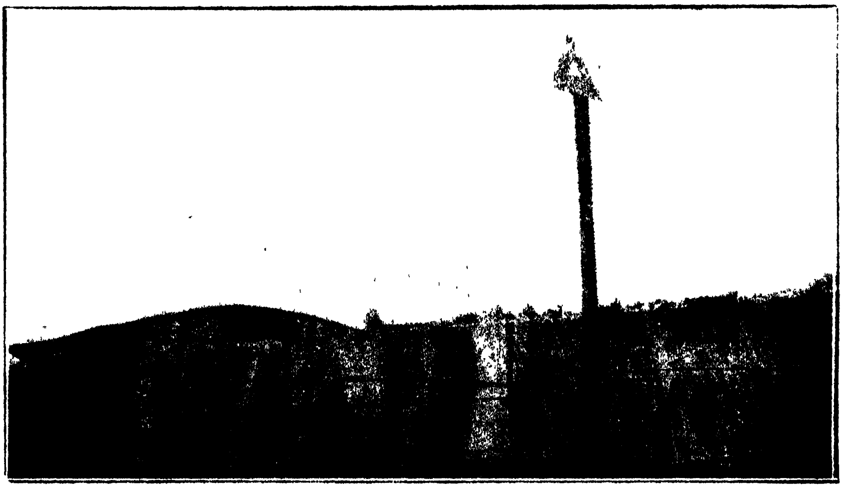
CURING.

No priming is done in this area, and therefore all the curing is that of whole plants.

Two methods of curing are carried on, namely, "sun and air curing combined" and "air-curing."

The first method is that of erecting scaffolds, very lightly covered with reeds or maize stalks, and hanging the whole stalks of tobacco under them. As the covering in most cases is very light, this is really "sun-curing."

This method gives very satisfactory results, provided fairly dry weather continues throughout the curing season. Much damage, however, is done annually due to rains, which discolour some of the tobacco.



[*Photo. by G. Corbett.*

2.—Sun-curing in Schoemanshoek under Scaffold.

In most cases the sides also are afterwards more or less enclosed with reeds as a protection against wind.

The period required to cure a crop under scaffolding is from four to six weeks.

The air-curing is similar to that in other parts of the country. The whole shed is made of thatch or reeds, but no effort is made to construct the buildings so as to be able to control even ventilation.

It takes from six to nine weeks to cure a crop in the sheds, depending on the weather.

After the tobacco is cured the stalks are taken down, leafed off, and the leaves tied in bundles and stacked in heaps. The tobacco is not graded, and here the grower is left in a quandary, as most manufacturers do not demand graded tobacco, whilst a few do. It would be advantageous to both farmer and manufacturer if grading is encouraged. The tobacco does not really go through much fermentation on the farm; in this direction the farmer also still has much to learn.

QUANTITY OF LEAF GROWN AND QUANTITY MANUFACTURED INTO ROLL.

Oudtshoorn District has always been the largest tobacco-growing district in the Cape.

Schenck, in his report on the cultivation of tobacco in the Cape Colony in 1887, remarks about the Oudtshoorn District:—"In the year 1865 the total production of tobacco in the Colony was 1,632,746 lb., of which Oudtshoorn produced 966,641 lb.; in the year 1875 the total colonial production of tobacco was 3,060,241 lb., of which Oudtshoorn produced 2,376,570 lb., almost four-fifths of the total Colonial production."

From excise statistics it appears that the quantity of leaf tobacco grown during the 1921-22 season was 2,523,659 lb.; during 1922-23 2,744,694 lb.; and 1923-24 2,947,234 lb. It is very difficult to estimate correctly, but the 1924-25 season's yield will at least equal, if it is not more than, last season's yield.

[*Photo. by G. Corbett.*

3.—Air-curing Tobacco-shed in Oudtshoorn District.

The ostrich feather slump seems to continue year by year, and each year more farmers go in for growing tobacco.

During the 1921-22 season 2,579,250 lb. of roll tobacco were manufactured, equivalent to 1,719,000 lb., or about 68 per cent. of the total leaf production.

During the 1922-23 season 2,241,277 lb. of roll tobacco were manufactured, representing 1,494,184 lb., or 54 per cent. of the total leaf produced. For the 1923-24 season 2,410,096 lb. of roll were manufactured from 54 per cent. of the total leaf produced.

From these figures one might conclude that the demand for lyed roll tobacco is a steady one.

In making these calculations one cannot arrive at absolute accuracy, as the gain in weight in manufacturing leaf into roll is not a definite factor. The writer has based his calculations on a gain of 50 per cent. in moisture in the process of manufacturing the leaf into roll.

LYE.

The Oudtshoorn roll tobacco differs from the other roll tobaccos in this country in that it is steeped in lye, where the others are steeped in water.

This lye or "loog-as" is the resultant ash procured from burning one of the Mesembrianthemums. The particular species used is the *Mesembrianthemum micranthum*.

This residual ash acts as a preservative, hence it is possible to have a considerably bigger percentage of moisture in the "loog" tobacco than in the ordinary water tobacco, without any danger of mould.

[*Photo. by V. F. Olivier.*

4.—Boiling Lye Solution in Tank.

The analysis of this lye, as given by Dr. C. F. Juritz in 1886, is as follows:—

Soluble material	52.10	per cent.
Consisting of:—		
Carbonic acid (CO_2)	18.35	,,
Phosphoric acid (P_2O_5)...	0.67	,,
Chlorine (Cl.)...	4.18	,,
Sulphuric acid (SO_3)	0.41	,,
Potash (K_2O)...	14.18	,,
Soda (Na_2O)	12.87	,,

Dr. Juritz further states:—"From the composition of this substance it is clear that its only action can be that of decomposing the tobacco; it contains such powerful bases as potash and soda in considerable proportion, forming more than one-half the weight of the ash. It is a known fact that solutions of such strong alkalies

decompose the nicotine of the tobacco. Some potash *may* be added to the tobacco leaf by means of a solution of 'lidjesbosch' ash, but, in any case, the main action of such a solution is to induce decomposition and not fermentation."

TIME TO BURN.

These bushes are only burnt at certain times of the year, i.e. when they ripen. They generally start ripening in December, but when this area has had good rains in September and October the bushes do not ripen until February. The ash procured from bushes cut when still green, or sprouting or flowering, is not suitable.

[*Photo. by V. F. Olivier.*

5.—Steeping Vat and Slanting Table on which Wet Tobacco is placed.

PREPARATION AND STRENGTH OF LYE.

The lye solution is prepared by boiling water in big receptacles and adding the ash when the water boils, and then to continue boiling until the correct strength is obtained.

Those manufacturers who have not made any scientific tests regarding the strength of their lye solution still employ the old method of testing the specific gravity with a fresh egg. The solution is supposed to have the correct strength when strong enough to float an egg about half-way out.

Most of the manufacturers to-day, however, use a hydrometer for heavy liquids, and the specific gravity reading varies between 1.15 and 1.25.

The proportions of ash to water are from 1-6 to 1-8, varying with the quality and texture of the tobacco, the heavier bodied tobacco being steeped in the stronger solution.

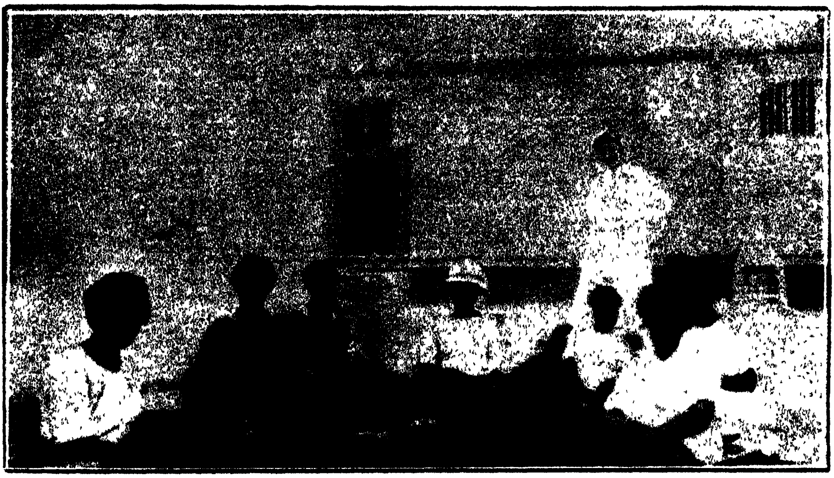
Some manufacturers also add some tobacco flavouring to the lye solution. Among the flavours used are rosewood, tonquin bean, champagne essence, Kentucky essence, liquorice, brandy, etc.

After the solution has attained the required strength it is poured into the steeping receptacles and allowed to cool.

Method and Period of Steeping.

The hands of tobacco are steeped into the cold lye solution for periods varying from one to ten minutes, sufficiently long to thoroughly wet the butt-ends of the hands.

All manufacturers do not steep the tobacco for the same period, whilst the time also varies with the moisture-content of the tobacco, the drier tobacco being steeped for a longer period.



[*Photo. by V. F. Olivier.*

6.—Sorting and Spreading Lyed Leaves.

The correct strength of lye and the correct period for steeping can only be ascertained by actual manufacturing experience.

From the steeping-vats the hands, after having first been shaken out, are thrown on slanting tables with corrugated-iron tops to drain. After the lye is properly drained off, the tobacco is tightly packed into fermenting-boxes, where it is left for from twenty-four to forty-eight hours. Under the old method the tobacco is left in these boxes for eight to ten days and allowed first to attain a very high degree of temperature, after which the tobacco goes through a cold sweat. This method insured that the tobacco would continue to keep in good condition after been manufactured into rolls.

The tobacco is now removed from the fermenting boxes and transferred to the sorters, who untie the hands and sort out the leaves into whole, broken, and scrappy leaves, spreading the whole and broken leaves out neatly.

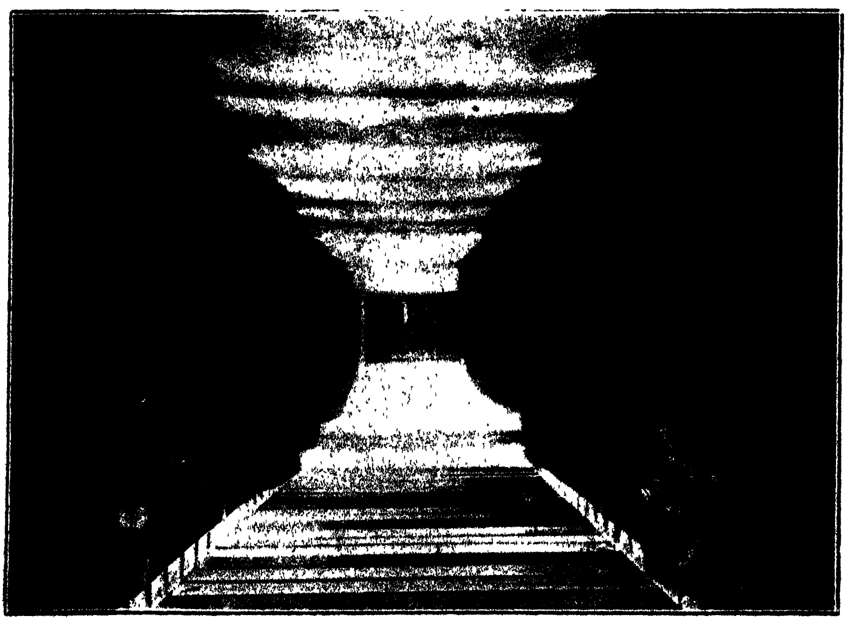
Manufacturing.

Each twister—that is the labourer who twists the leaves into long strings—has a heap of whole leaf for wrappers and a heap of broken leaf for fillers.

Three to five filler-leaves are pressed together by hand and the wrapper-leaf is then neatly wrapped round the filler; the fillers overlap on the inside with the wrappers overlapping on the outside, thus giving a long continuous string of tobacco from which the rolls are eventually made.

[*Photo. by V. F. Oliver.*

7.—String of Tobacco and Twenty-pound Roll.



8.—Tobacco Stacks: Fermenting prior to Manufacture.

There are different types of twist, namely, thin or special, medium, and thick or ordinary. The thinner the twist the less the number of filler-leaves used and the more expensive the roll, due to higher cost of production, the twisters being paid more per lb. for thin twist than for thick. The twister either has the string of tobacco being twisted in coils on the floor or twisted on to spindles.

These coils or strings of tobacco go from here to the roll-makers, who make the various size rolls, ranging from 1 to 50 lb. per roll.

The Oudtshoorn roll tobaccos have a bright gloss, due to the vaseline or fat used by the twisters on the wrapper-leaves when making the strings. This vaseline or fat serves two purposes—it helps to preserve the hands of the labourers and also imparts a gloss to the tobacco. In some cases almond, lemon, or other kindred essence is added to the vaseline to impart a scent to the tobacco.

CONCLUSION.

Although there are machines for making roll tobacco, fully 98 per cent. of the roll tobacco is manufactured by hand, due to a decided preference shown by retailers and consumers for the hand-made article.

The roll tobacco industry is to-day still one of the most important industries in these sections, offering employment to hundreds and changing the raw material into the manufactured article, thus providing a market for nearly 60 per cent. of the leaf produced in this area.

The industry offers a big field for investigational work, which the writer hopes to continue as soon as possible

The writer is indebted to Mr. K. Schenck, Oudtshoorn, for the loan of the two reports given as references and also for the analysis of lye; also indebted to Messrs. M. Kaplan & Co., Ltd., Oudtshoorn, for allowing him to take the photos in their factory.

References:

(1) Report on the Cultivation of Tobacco in the Colony. K. Schenck, 1887.

(2) Report of the Department of Agriculture for the year 1887.

Nurseries in Quarantine at the 1st January, 1926.

Name.	Address.	Cause of Quarantine.	Extent of Quarantine.
Distributors Co., Craighall Nursery	Craighall, Johannesburg	Crown-gall and Root-gall Worm	Deciduous, all.
D. J. Conradie & Bros.	Robertson, C.P. ...	Red Scale ...	Citrus, all.
A. S. Strydom & Co. ...	Krakeel River ...	Woolly Aphis ...	Deciduous, part.
G. J. Labuschagne ...	Groot Marico ...	Red Scale ...	Citrus, all.
Distributors Co., Craighall Nursery	Craighall, Johannesburg	Pernicious Scale...	Deciduous, part.
C. A. Geerdts	Lydenburg ...	Pernicious Scale...	Deciduous, all.

SHEEP BLOW-FLY CONTROL.

Fly-traps: Their Construction and Operation.

By BERNARD SMIT, M.Sc., B.Sc. (Agric.), Entomologist, Grootfontein School of Agriculture.

THE control of the sheep blow-fly, as with the control of so many other insect pests, cannot be accomplished by a single measure. There are several points at which this enemy of the sheep farmer of South Africa may be attacked, and in order to combat it successfully, it should be attacked simultaneously at all these points.

The trapping of the adult flies is one important method of control, and one that is gaining favour throughout the country. It should be understood, however, that trapping must always be a supplementary measure. Enormous numbers of flies may be caught in traps. It has been proved at Grootfontein that systematic trapping of sheep blow-flies greatly reduces the danger of sheep being attacked, but several weeks may elapse between the time the flies emerge and the time they are caught, and during this period they have an opportunity of attacking the sheep.

The first step in the control of the flies, the house-fly as well as the blow-fly, is the destruction of their breeding places. This was briefly dealt with in a previous article in respect of the blow-fly.* When this has been done, attention may then be devoted to the trapping of the flies that have escaped destruction as maggots and have developed in some breeding place that has been overlooked.

The number of flies caught in a trap does not always indicate the amount of good the trap is doing. In winter comparatively few flies are caught in traps, but the destruction of these flies is very important, because it is largely from them that the hordes of summer flies originate. Flies develop much slower in winter than in summer, and a correspondingly slow rate of catching in winter results in as efficient control as a fast rate in summer. It is during the winter months, indeed, that traps are most efficient. They gain on the flies because during very cold weather no flies emerge at all, whereas some flies are always caught. During June and July of 1924 six traps on Grootfontein caught a total of 3,697 flies, 1,154 of which were sheep maggot flies. From life-history records, it is believed that no flies emerged on the farm during these two months.

TYPES OF FLY-TRAPS.

A great many different types of fly-traps have been invented, nearly all of them acting on the same principles, and making use of the fact that flies have a tendency to walk upwards and towards the light. An essential of these traps is a cone or tent of wire gauze, having a wide opening below and a small aperture above, so arranged

* See November, 1925, issue of the *Agricultural Journal.*

that the flies can easily get into the trap and when once in cannot easily find their way out. The trap itself is usually in the form of a wire-gauze cage.

The ideal trap is the one that is most easily and cheaply made, is durable, needs little attention when once set up, and is efficient.

A great deal of work has been carried out in Australia and the United States of America in attempts to devise a suitable fly-trap and considerable success has been attained. The standard Australian trap for blow-flies is made of a single petrol tin with its top cut open. The top is then covered with a square of wire gauze with a large round hole in its centre. Into this hole is fitted a gauze cone, in such a way that the cone hangs into the tin in an inverted position. The bait is put into the bottom of the tin before this cover is put on, and the smell of the bait is relied upon to attract the flies into the tin through the cone. This trap is very simple and easily made.

The standard American trap is made entirely of wire gauze on a wooden frame-work, and consists of a large gauze cylinder with a large upright gauze cone inside it. The top is made of a barrel head, and has a gauze door in it for emptying the trap. The bait is contained in a shallow pan placed on the ground under the trap (see accompanying photograph). Both these traps have been tested during the past three years at Grootfontein, but, unfortunately, have not proved satisfactory. Month after month the Australian and American traps were found to have caught very few flies, although they were placed in ideal positions and kept well baited.

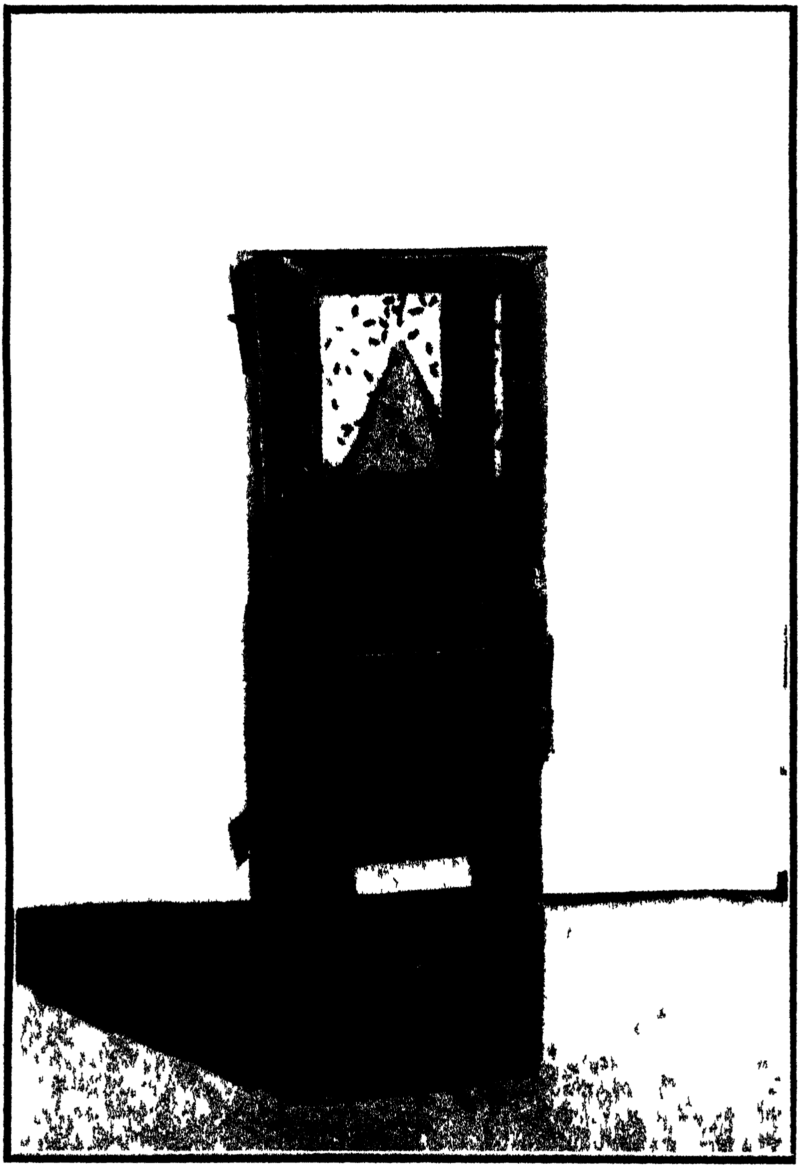
Various other types of fly-traps have been tried, including several tent traps and a trap made of a petrol case, but none of these proved satisfactory. In 1922 Mr. W. E. Edwards, of Schoombie, invented a trap made of two petrol tins placed one above the other, the upper one being the trap proper, with a wire-gauze cone fastened into it, and the lower one containing the bait. Flies entered the lower tin through slots cut in its sides, and were then attracted into the upper tin by light let in through a gauze window in the top of the trap. This trap was fully described (by Wahl and Du Plessis) in the November, 1923, number of this *Journal*. It was subsequently improved by Wahl, who found that its efficiency could be greatly increased by putting gauze windows in the sides of the upper tin similar to that in its top. It has been further improved by the writer, and is now described in detail so that farmers and others wishing to make and use this trap may benefit by our experience and construct them according to the latest design.

THE IMPROVED TRAP.

The trap consists of two paraffin or petrol tins placed one above the other and held in position by a strip of sheet metal (Fig. 1). The upper tin is the trap proper and, as stated above, contains a wire-gauze cone or pyramid fastened in an upright position, its apex being three inches from the top of the tin and its base secured on the inside of the bottom edge of the tin.

The first step in making the trap is to mark out the windows in the sides and top of the upper tin. Details of these apertures can best be seen by reference to Figures 1 and 2. They are made of such a size that there is a strip of tin one inch wide left all around them except at their lower sides, where the strip is two inches wide. This

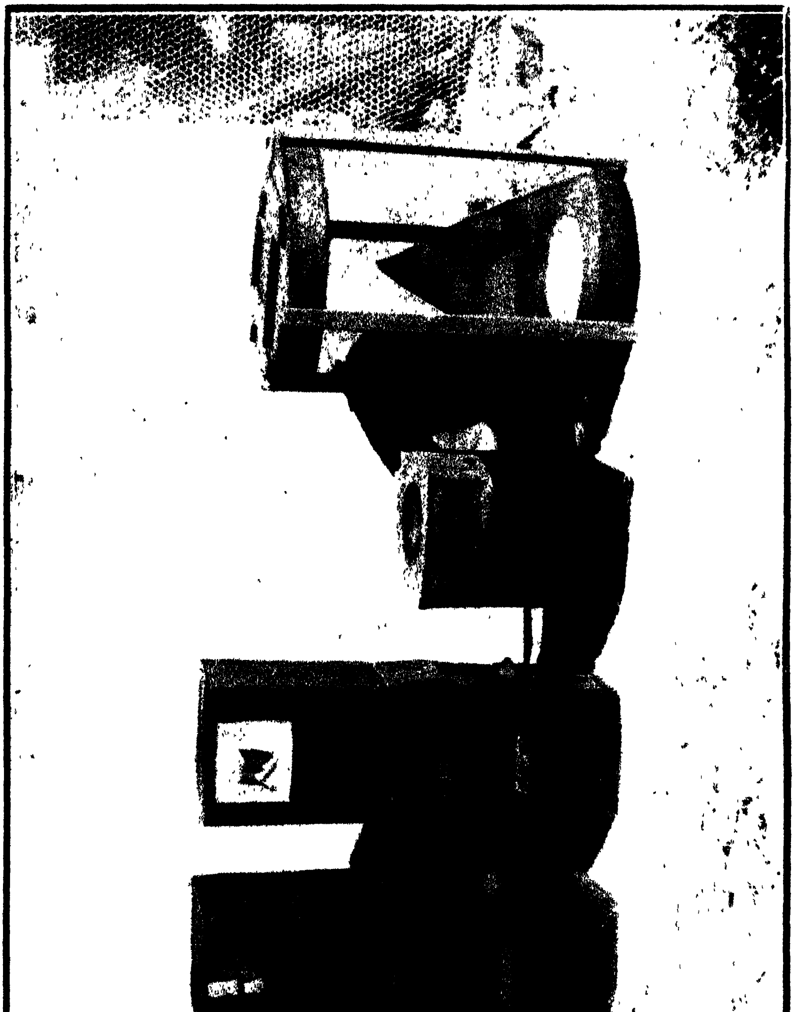
leaves enough of the tin to give rigidity to the trap and enable the gauze to be fastened in place. Then mark out the hole "x" (Fig. 1) and the position of the cuts to be made in the bottom end of the tin,



No. 1. The Improved Trap half full of Sheep Blow Flies. Note the position of the cone and the support of the wooden wedge holding the lid in place.

as shown in Figure 3. The round hole "x" (Fig. 1) is for the purpose of emptying the trap of flies when it is in operation. The hole is cut to fit the lid of a treacle tin, which is used to close it. Place

the lid of a treacle tin with its inside surface against the side of the upper tin where it is to be fitted and scratch around its inside edge with a nail. The window on the side in which this hole is to be made is made smaller than those on the other three sides of the



No. 2. The Four Types of Traps. From left to right: The Improved Trap, the Edwards Trap, the Australian Trap, and the American Trap.

tin, in order to leave plenty of room for making this hole. The upper edge of this window should be five inches from the top of the tin, and the upper edge of the hole "x" half an inch from the top of the tin (Fig. 1).

Before cutting the apertures in the tin, small holes must be punched around the edges of the windows, using a thin nail and a hammer and making the holes half an inch from the apertures and one inch apart as at "y" (Fig. 1). These are for the purpose of sewing in the gauze windows, which is done with thin copper wire.

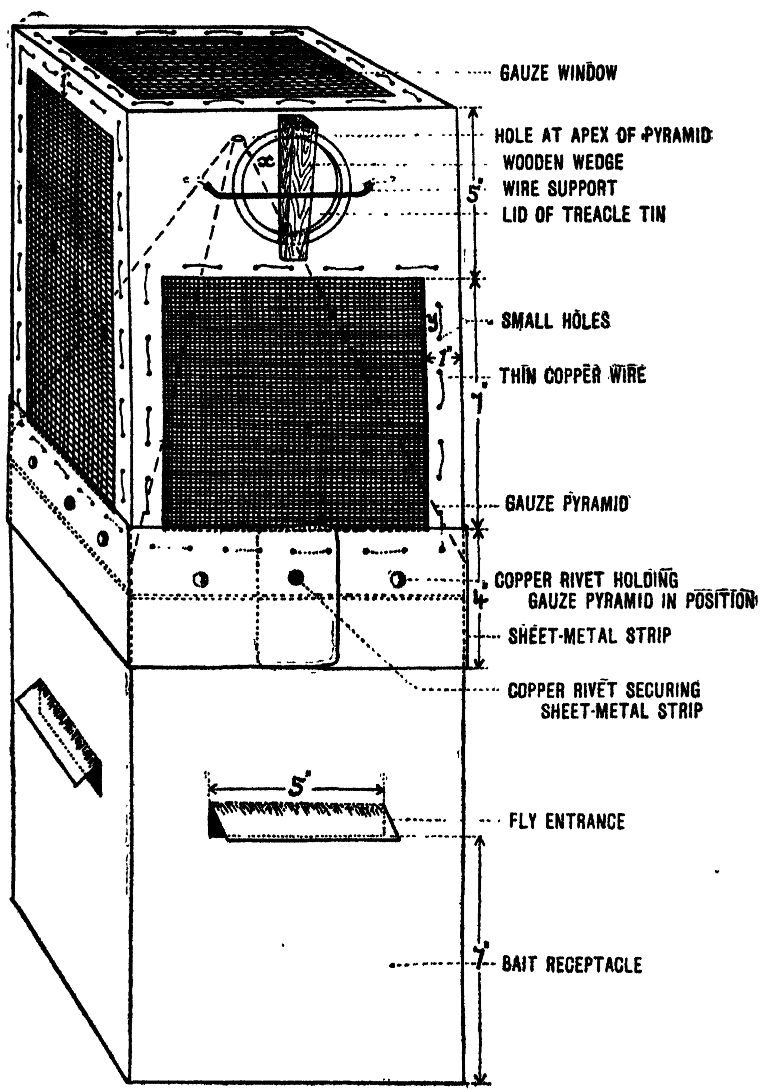


Figure 1.

The apertures are then cut with an old pair of scissors or a tin cutter. In cutting out the bottom end of the tin a strip one inch wide is left all around the inside of its bottom edge. Slit this strip at the corners of the tin as at "a" (Fig. 3) leaving four flaps "b" as shown in the figure.

Two holes are punched with a stout nail, one at each side of the hole "x" (Fig. 1), and a stout piece of wire is bent through these over the hole, as shown in the figure. This piece of wire serves as a support for a wooden wedge which is used to keep the treacle-tin lid in place while the trap is in operation.

The gauze is next fastened into the windows. Pieces of good 12 or 14 mesh wire gauze, preferably galvanized, are cut to fit the openings so that there is an inch to spare on each side. They are fitted on the inside of the tin and sewn in place with thin No. 22 standard gauze, copper wire threaded through the holes "y" (Fig. 1). The square of gauze in the top of the trap should be sewn in first, then those in the sides, and finally the gauze cone is fastened in place.

THE CONSTRUCTION OF THE CONE.

It is a common but mistaken idea that the cone of one of these traps is difficult to make. There is no difficulty if a little care is taken. It is best, however, to cut out a paper pattern of the cone and when this is found to fit correctly, cut the gauze to coincide with it. The pyramid or cone has four sides to correspond to the sides of the trap, each side being a triangle with its base as long as the width of the trap and its height nearly that of the height of the cone. The pattern is as shown in Figure 4, on which the measurements are given. First strike out the arc of a circle with centre A and radius of twelve inches. Then mark off the points B, C, D, E, and F along this arc so that they are nine and a quarter inches apart. Draw lines joining these points and to the point A and proceed as shown in the figure. Strips of gauze one inch wide are left along the line AF and at BC, CD, DE, and EF (Fig. 4), in order to sew the cone into shape and to fasten it into the trap. The gauze when cut to shape is folded along the lines AC, AD, AE, and AF, so that the strip AF overlaps the edge AB, and these are then sewn together with copper wire, the same as was used for sewing in the windows. The apex of the cone will then be closed. After the cone is riveted into the trap, a hole must be made in the top of it through which the flies are to enter. This is best done by pushing a thick pencil up through the tip of the pyramid; the gauze will part at this point, the thin wires bending aside, and leaving a round hole of the required size.

To fasten the cone into the trap, its base is fitted under the flaps "b" (Fig. 3) which were left on the inside edges of the bottom of the tin and which are now bent inwards against its sides and secured tightly over the strips of the cone. BC, CD, DE, and EF (Fig. 4). The flaps are secured with split copper rivets such as those used in harness making. These rivets are put through the sides of the tin, the strips at the base of the cone and the flaps. Two rivets through each flap are sufficient (see section of upper tin, Fig. 2).

In order to keep the upper tin in position on the lower tin, a strip of sheet metal or paraffin tin, four inches wide and forty inches long, is riveted on the outside of the bottom edge of the upper tin. It is fastened so that it projects two inches below the edge and over the upper edge of the lower tin. Split copper rivets are used to fasten it in place. It serves to strengthen the trap in addition to keeping the tins in position. The ends of this strip will overlap on one side of the trap and one rivet should be put through both ends at this point. The upper tin or trap proper is now complete.

The lower tin or bait receptacle consists simply of a petrol tin of the same size as that used for the upper tin. Its top is cut open and four slots are cut in its sides through which the flies, attracted by the bait, enter. These slots, one on each side of the trap, are

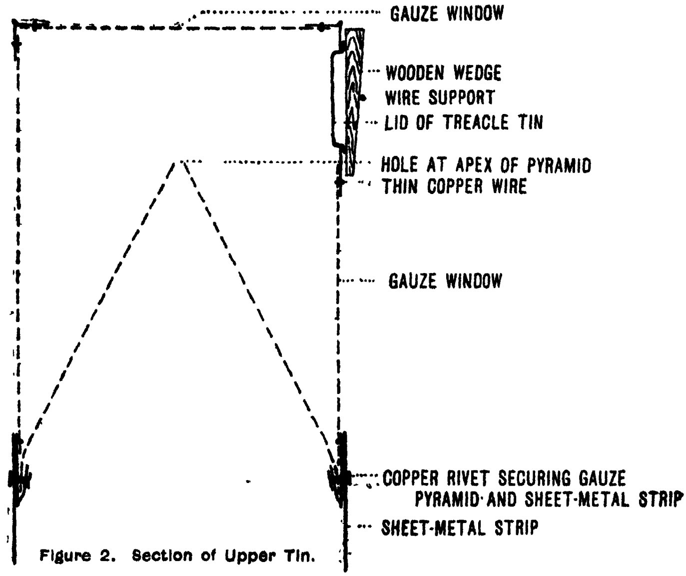


Figure 2. Section of Upper Tin.

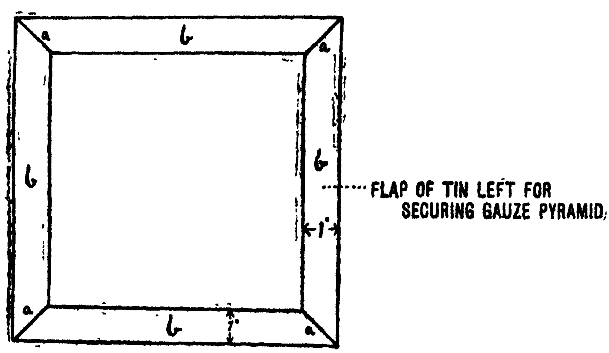


Figure 3. Bottom of Upper Tin.

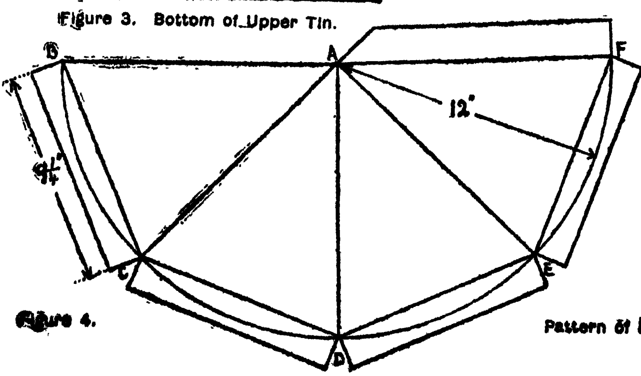


Figure 4. Pattern of Pyramid.

formed by making a horizontal cut, five inches long, at a distance of seven inches from the bottom of the tin on each side. At each end of these cuts are perpendicular cuts, one inch long, running up from them. The flaps so produced are bent outward, as shown in Figure 1. The object of these flaps is to prevent light from entering the slots and so prevent the flies from being attracted out through them after entering. The flaps do not hinder the flies from entering, because the flies find their way to them by walking up the outside of the trap.

When completed, the trap, and particularly the inside of the lower tin, should be painted with good thick paint to prevent it from rusting. The gauze should not be painted, as this hinders light from shining through it.

It has often been suggested to use a larger tin for the trap proper fitting over a smaller tin as the bait receptacle. This has been tried, but it has been found better to use tins of the same size for both the upper and lower part of the trap, and to rely on the strip of sheet metal to keep them together.

BAITS.

Numerous forms of bait have been recommended, and the bait to use depends largely on the kind of fly to be caught and on the materials that are available. Sheep blow-flies are very strongly attracted by decaying animal matter in which they breed naturally. The faster it decays and the greater its stench the more attractive it becomes. It is therefore during the first few days after decomposition sets in that meat is most attractive to blow-flies. Decomposition progresses faster in summer than in winter, but, on the other hand, such bait does not remain attractive as long in warm weather as it does in cold weather. Bishopp, of the United States Bureau of Entomology, recommends the mucous membranes which form the lining of the intestines of cattle as a good bait for blow-flies, but it is our experience that any decaying meat is very effective. Solid meat like that cut from a dead cow or a horse remains attractive longer than entrails and odd scraps. Entrails, etc., are very good, however, and are easily obtainable on most farms. In Australia dead rabbits are often used. In South Africa their place may be taken by springhares, rats, and any small animals killed on the farm. Such animals should be cut open to expose the intestines before throwing them into the trap. It will readily be seen that such traps as are here described provide an excellent means of disposing of carrion.

During the early part of the summer in the Karroo, when the weather is very dry and windy, it is necessary to add water to the bait, otherwise it will soon dry up and stop smelling. The lower part of the trap is filled with the bait up to within an inch of the fly entrances and a quart or so of water poured over it. Instead of using pure water for this purpose it has been found necessary to use a weak solution of tobacco extract in order to prevent fly maggots from developing in the bait. One part of tobacco extract containing 8 per cent. of nicotine used in fifty parts of water has proved effective. It kills all maggots in the bait and does not retard decomposition. A solution of borax—one ounce of powdered borax to each gallon of water—will also prevent maggots from developing in the bait, but it tends to check decomposition.

FOR HOUSE-FLIES.

The trap here described is very efficient for the destruction of house-flies. Meat will attract large numbers of house-flies, but the following bait is claimed to be better for this particular species:—The curd of sour milk mixed with cheap brown sugar at the rate of half a pound of sugar to each pound of curd. The mixture is then wetted with water. The addition of bran to this mixture makes a more lasting bait of it.

EFFICIENCY OF THE TRAP.

When baited with meat moistened with a solution of tobacco extract, enormous numbers of flies will be caught in these traps. During October, November, and December of 1924, one of these traps on Grootfontein caught a total of 252,070 flies, of which 160,540 were sheep blow-flies. The volume of these flies was ten and a half gallons, or over two and a half paraffin tins full. The trap acted so well that during part of this period it was necessary to empty it twice a week to keep the level of the dead flies in the upper tin below the top of the cone, and so prevent the trap from being clogged.

An experiment has been run throughout the past fly-season to determine the relative efficiency of the following four types of traps: The Australian, the American, the Edwards (as described by Wahl and Du Plessis, 1923), and the trap here described. Two sets of these traps were set out on Grootfontein, one near the river and one on the open veld near a drinking trough at the corner of four sheep paddocks. The four traps in each set were placed at the corners of an enclosure ten feet square, and their relative positions were changed once a week throughout the year. They were baited at the beginning and emptied of flies at the end of each month. The flies were then identified and counted.

The table gives the total number of flies caught each month in the two traps of each type, and the total number of flies caught in the two traps of each type during the whole year. It will be seen that in the two improved traps 310,164 flies were caught, which is over twice as many as were caught in all the other traps together.

TABLE 1.

	1924.						1925.						Total for Year.
	July.	August.	September.	October	November	December.	January.	February.	March.	April.	May.	June.	
Two Improved Traps	1,286	201	8,217	86,083	88,303	77,797	38,284	618	3,160	4,192	1,348	675	310,164
Two Edwards Traps	454	182	1,197	31,636	24,356	3,550	8,858	349	13,751	21,178	387	—	105,898
Two Australian Traps	294	80	156	709	594	96	331	—	—	—	—	—	2,260
Two American Traps	87	19	407	236	1,797	231	—	—	10,304	1,713	—	54	14,848

SPECIES OF FLIES CAUGHT.

Only a portion of the flies caught in these traps were sheep blow-flies. It must be remembered that of the numerous species of blow-flies found in South Africa, only three have thus far been found to attack sheep. They are: *Lucilia sericata*, *Chrysomyia albiceps*, and *Chrysomyia chloropyga*. Among the other species of flies caught, the most numerous was the common house-fly, *Musca domestica*. Next came *Chrysomyia marginale*, the big blue blow-fly; this, as far as we know, does not strike sheep, but breeds freely in carrion.

Other flies caught in lesser numbers were:—*Calliphora croceipalpis*, a large black blow-fly which appears early in spring. *Sarcophaga haemorrhoidalis*, the large grey flesh-fly with a checkered abdomen which deposits its maggots on meat. *Wohlfartia euvittata*, the large grey locust-fly which will also deposit its maggots on meat. *Pyrellia splendida*, a bright green fly which looks very much like *Lucilia sericata*, the sheep-maggot fly, but which breeds in cowdung and does not attack sheep. *Muscina stabulans*, a fly which looks something like a large house-fly. It also breeds in meat.

Several other species of flies are often caught in the traps, but in negligible numbers.

OPERATION OF THE TRAP.

The operation of the trap is very simple. Once it is baited it can usually be left for three weeks or a month without attention, except for the addition from time to time of a little water to the bait in dry weather. When the bait has decomposed and stopped smelling, it must be renewed. To empty the trap, pull the upper tin off the lower one, turn it on its side with the hole closed by the treacle-tin lid downwards, remove the wooden wedge and the lid and shake out the dead flies. The flies which are still alive in the trap will fly upwards and will not escape through the hole. Replace the lid and the wedge and set the trap back on the lower tin. It is not necessary to kill the flies in the trap. A few days after being caught they will die from their efforts to escape.

WHERE TO SET THE TRAPS.

There should be ten or twelve of these traps on every farm. Flies are more abundant near rivers and dams and in sheltered bush country than in the open veld. The traps should, therefore, be set up in such places, especially where sheep congregate, in order to catch the flies in large numbers and to attract them away from the sheep. Set the traps near drinking troughs or in small paddocks where valuable sheep are fed. There should be at least two baited for house-flies near the homestead, preferably near the stables. Each trap should be secured to a fencing standard with a loop of baling wire to prevent it from being knocked over, and care should be taken that grass and weeds do not grow around it so as to obstruct the fly entrances in the lower tin. Where weeds and grass grow abundantly it is advisable to stand the traps on squares of sheet metal, or pieces of corrugated iron. These sheets of iron should be at least three feet square, so as to keep grass and weeds from growing too near the trap.

The traps, if properly looked after, will last for three or four years. The lower tin may need renewing occasionally, but this is very easily done.

COST OF TRAPS.

The cost of the improved trap here described is very small. The materials required and their cost are given in the following table:—

	s.	d.
2 petrol tins	1	0
1 yard of wire gauze, 36 inches wide, at 2s. 9d. per yard	2	9
1 strip of sheet metal, 4 by 40 inches, at 12s. 6d. per sheet, 3½ by 6 feet	0	8½
Copper rivets, at 9d. per box of 100	0	1
Thin copper wire, at 9d. per coil	0	1½
Total	4	8

Empty petrol tins are now found on almost every farm in the country, and the other materials needed for the construction of the trap are easily obtainable at any general dealer.

An intelligent native boy can soon be taught to make these traps, and in many places there are tin-smiths, handy-men, and others who will make them cheaply.

Sheep blow-flies are responsible for an enormous annual loss of time and money to the sheep farmer of South Africa, and the position appears to be getting worse. By systematic trapping a great deal can be done to reduce the numbers of flies on the farm, and hence the trouble and loss they cause. If trapping is carried out in conjunction with other methods of attack it is believed that the sheep blow-fly pest can be controlled and great loss to the country avoided.

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THE NUTRITIVE VALUE OF MILK.

By M. J. DAVIDTSZ, Division of Extension.

To estimate the food value of milk, one must consider its constituents and its digestibility, as well as the fact that it is a food most admirably suited for the feeding of infants and invalids.

Milk is nature's perfect food. We do not class it as a beverage. It contains all the materials necessary for normal growth and development. For the first nine months the child thrives on milk. The child grows rapidly. At the end of six months it should double its original weight, and at the end of the first year the original weight should be trebled. This rapid growth points to the efficiency of milk as a food.

The cow has often been alluded to as "man's foster-mother." Throughout the first years of life, milk should be the foundation of the diet on which to build the daily energy and full requirements.

There is often the danger of children suffering from the lack of sufficient milk in the diet. Malnutrition is very high in this country. Medical inspectors of schools have sometimes found it to be as high as 75 per cent. It is safe to say that a large percentage of these cases is due to the lack of sufficient milk.

Experiments have been made to determine what quantity of milk is necessary per day. Groups were formed and given 2, 3, 4, 5, and 6 cups of milk daily, in addition to the ordinary food. When finally the results were determined, the height and weight charts, as well as such factors as general intelligence and vitality, showed some startling figures. The children with 2 cups of milk were inferior, while those with the 3 cups were considerably better off. There was a marked difference between those of 3 cups and of 4 cups, in favour of the latter. The difference between those that daily had 2 cups and those that had 4 cups was very great indeed. On the other hand, there seemed to be no difference between those who had 4, 5, and 6 cups daily. This shows very clearly that, whereas the body can use to its best ability all the building and growing material in 4 cups of milk, it does not need the extra material in the additional cups. The body throws these out again. It seems, therefore, reasonable to conclude that the growing child needs four cups of milk daily for the best growth and development. Tea and coffee not only have no food value, but they act as drugs, stimulating a system that is full of vitality and needing no stimulation. Moreover, after the palate has accepted the higher flavour of tea and coffee it will reject milk, which is somewhat bland in flavour. Where it is not possible to give the four cups in whole milk, skim milk may be used. It must, however, not be regarded as a substitute. The only constituent removed from skim milk is the butter fat. This constituent, however, is so very important that children should not be allowed to go without it.

Extra butter or cream should be put back into the diet. Lard or other animal fat is not adequate and cannot replace butter.

Cream, butter, and milk are very rich in the content of vitamin A. This vitamin is a fat soluble, and is very essential in the diet. Its absence will cause an eye disease known as Xerophthalmia. White rats and guinea-pigs put on an " A-free diet " will develop red and swollen eyes very quickly. The eye will continue to swell, and unless the A vitamin is replaced in the diet total blindness will follow. The skin is also affected.

Recently in a school in the middle west of the United States it was found that a certain number of the children were always suffering from skin and eye trouble. When the medical board investigated they found that these children came chiefly from a quarter where only small amounts of milk were used. On account of the high prices, butter and cream were used very sparingly, if at all. Other sources of A vitamin, such as eggs, were also neglected. Instruction along these lines was given to the students and talks to the parents, with the result that this trouble soon ceased.

There are parts in South Africa where my attention has been drawn to similar cases, notably places where there have been severe droughts, also where the importance of milk and milk products, eggs, and green vegetables in the diet is not realized.

Apart from the importance given to milk by its vitamin content, its value is still very high on account of its important mineral salts. Chief of these is calcium, which builds the bone tissue of the skeleton, including teeth. Ricketts is the disease resulting from the lack of calcium in the diet. The bones of animals and humans, where there has been a deficiency of calcium, are soft and spongy compared to those where the calcium supply has been sufficient. It is during the early years that this supply should not be neglected. Before the first set of teeth are ready to drop out, a good foundation should be laid for the next lot. Often when a primary tooth drops out the next is there already perfectly formed. It is therefore highly essential that during childhood, more than at any other time, there should be no shortage of milk, and attention should be paid to the calcium content of food. Milk and eggs are the two most important sources of this mineral. A large percentage of " bowleggedness " is due to a deficiency of calcium, and in many cases where the limbs break easily investigation has shown that there has been a lack of calcium.

The proteins of milk are also very important. The function of proteins on the whole is to build new tissues and to replace old, broken down ones. Some proteins are much more effective for building than others. Thus it is the quality and not the quantity of the proteins that is of importance. Milk contains several proteins, but those of chief importance are *Casein* and *Lactalbumin.*

Casein is found in cheese as it is retained in the curd *Lactalbumin* runs off in the whey. These two proteins differ chemically and also somewhat in nutritive value. Lactalbumin is a little more efficient for growth than casein, but both will produce normal growth. Casein, which constitutes about 80 per cent. of milk proteins, is the most easily digested protein. This is why milk is such a desirable food for babies and invalids as well as for persons with weak digestions.

Milk, therefore, should never be regarded as a luxury or an expense. It combines very well with such foods as cereals. The proteins of cereals are somewhat deficient and are not builders. Supplemented, however, by the proteins from milk, the nutritive value is heightened considerably. Bearing in mind the importance of the vitamins and mineral salts, a good milk supply is a necessity. It is an article which should never be neglected in the diet, and should be planned for first of all before consideration is given to such foods as meats.

Abolition of Duty on S.A. Wool.

Mr. S. B. Hollings, Bradford, states, *inter alia*, in a letter dated 26th November, 1925, that as a result of the visit to Bradford of Mr. A. G. Michaelian, principal sheep and wool expert of the Union Government Department of Agriculture, the extra ¼d. previously charged for combing South African Merino wool has been abolished. Mr. Michaelian's contention was that the bulk of the S.A. wools were now as good as those grown in Australia, and that they ought therefore to be put on the same basis of charges. The granting of this concession is accompanied by an all-round reduction in charges, for it was decided that from the 23rd November, 1925, there should be a reduction of ½d. per lb. in Merinos.

Mr. Michaelian is to be congratulated on the work he did in Bradford. He brought home to the combers the unfairness of their attitude. He recognized that in years gone by S.A. wools were notorious for bad combing results on account of false packing, shortness of staple, and the presence in the wool of large quantities of extraneous matter, but was equally persistent in his claim that better and more up-to-date systems of preparing wool for market have resulted in South African wools now being on a parity with those produced in Australia. The abolition of the extra charge is the best comment possible on the improvement that has taken place. There is no doubt that South African wools have greatly improved in character during the past five years. The writer has received samples of this season's wool sold at Port Elizabeth which it has been a real treat to see. Those who saw the samples expressed the same delight at seeing the great change that had come over the wools in general. South Africa has proved what we have been claiming for the past twenty-five years, namely, that the country itself was not at fault, but that the lack of sound principles of breeding and caring for sheep was the prime cause of the trouble. That has been demonstrated beyond doubt, for the wools we have seen out of this season's clip cannot be beaten, except in the speciality clips of Australia.

It is scarcely possible to over-estimate the beneficial results which will follow from the above-mentioned reduction in combing charges. They constitute a most important contribution to the modification of overhead charges, for which wool-users in Bradford and district have been agitating for a considerable period. Their plea, quite a sound one, has been that the high cost of wool, coupled with excessive costs for combing, spinning, and all other operations, have simply been killing trade and preventing the absorption of wool on an adequate scale.

HOW TO CONDUCT A POST-MORTEM AND TO COLLECT SPECIMENS FOR LABORATORY EXAMINATION.

By G. v. d. W. de Kock, M.R.C.V.S., Dr.Med.Vet., Division of Veterinary Education and Research, Onderstepoort, Pretoria.

There is perhaps no branch in veterinary science that can give veterinarians and stockowners so much information about disease in animals as a properly conducted post-mortem. That is why practically every farmer recognizes its value, and in case of deaths amongst stock, carcasses are opened and examined to ascertain the cause. Post-mortems are made in such a crude way, however, that in the majority of cases important organs are overlooked and not examined. In the great majority of cases the specimens collected at such post-mortems are forwarded to the Division of Veterinary Education and Research, accompanied by very incomplete post-mortem reports, and yet it is expected that a diagnosis must be made. These specimens are frequently sent without the addition of any preservative whatsoever, with the result that the material arrives at Onderstepoort so decomposed that it cannot be utilized at all. It stands to reason that such specimens and reports do not assist in the least in arriving at a diagnosis of the disease reported on. The stockowners naturally derive no satisfaction from such procedure.

It must be remembered that a definite diagnosis can be made in the laboratory from specimens in the case of a number of animal diseases, provided suitable material is forwarded for examination. One might, for example, mention the following diseases:—Tuberculosis, bovine bacillary necrosis, jaagsiekte in horses and sheep, dunsiekte in horses and bovines, Johne's disease, horse-sickness (dunkop), heartwater, East Coast fever, snotsiekte, actinomycosis, lung-sickness, infectious anaemia of equines, various inflammatory conditions of the lungs, kidneys, liver, stomach, intestines, etc., cases of arsenical poisoning, various tumours, various parasitic diseases, including parasitic cysts, reksiekte, etc.

This short paper is solely meant as a standby for farmers and stockowners who are not in a position to obtain expert advice immediately. It is intended to consider this subject under the headings: Procedure to be adopted in making and recording a post-mortem; How to make blood and organ smears; Collection of material for laboratory diagnosis; and the dispatch of smears and specimens.

PROCEDURE TO BE ADOPTED IN MAKING AND RECORDING A POST-MORTEM.

(1) *Warning.*—Do not attempt a post-mortem where there has been any suspicion of anthrax. Make the usual blood-smears from such carcasses, and proceed at once with the destruction of the carcass as laid down in the stock diseases regulations.

Cases of suspected glanders in equines should in no circumstances be dealt with by any one except a veterinarian.

(2) *Requirements.*—(*a*) A strong knife, preferably a butcher's knife (as in fig. 10); (*b*) a strong pair of scissors is very useful (as in fig. 10); (*c*) a carpenter's or butcher's saw; (*d*) an axe; (*e*) disinfectant

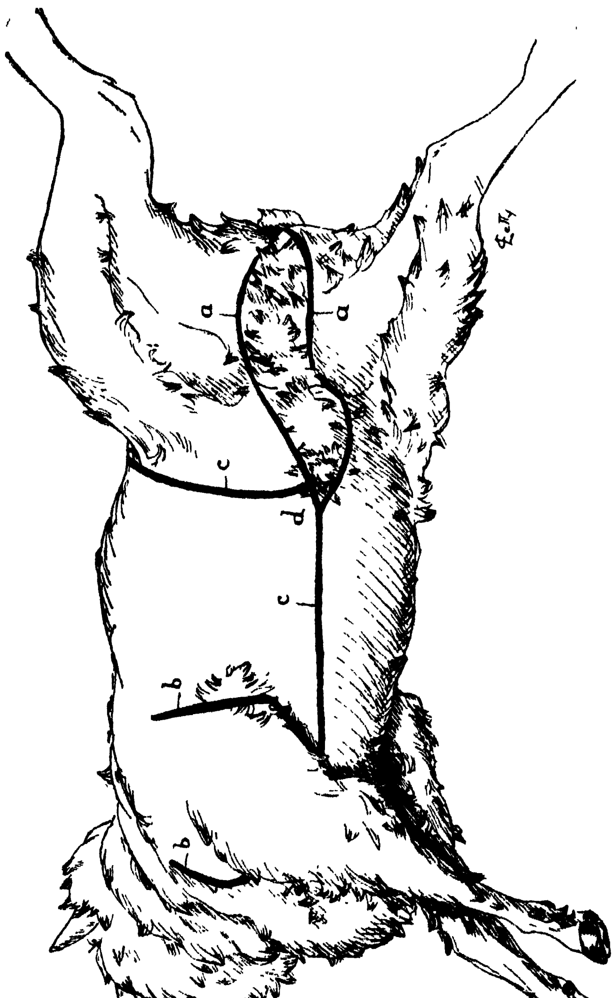


Fig. 1.
Black lines indicate lines of incision.

is very useful, especially in case of accidental wounds on the hands of the operator; (*f*) highly desirable is a good supply of water to wash organs from time to time if necessary; (*g*) if a suitable bench or table is not available, then select a place where there is plenty of grass on which the organs can be placed as they are removed from the

carcass; (*h*) glass-slides to make blood and organ smears; (*i*) glass jars with some preservative for the collection of specimens.

(3) *Avoidance of Delay.*—Conduct the post-mortem as soon after death as possible, because decomposition (especially in this country) sets in rapidly, and a few hours' delay may change the appearance of the majority of organs to such an extent that they become unsuitable for a diagnosis.

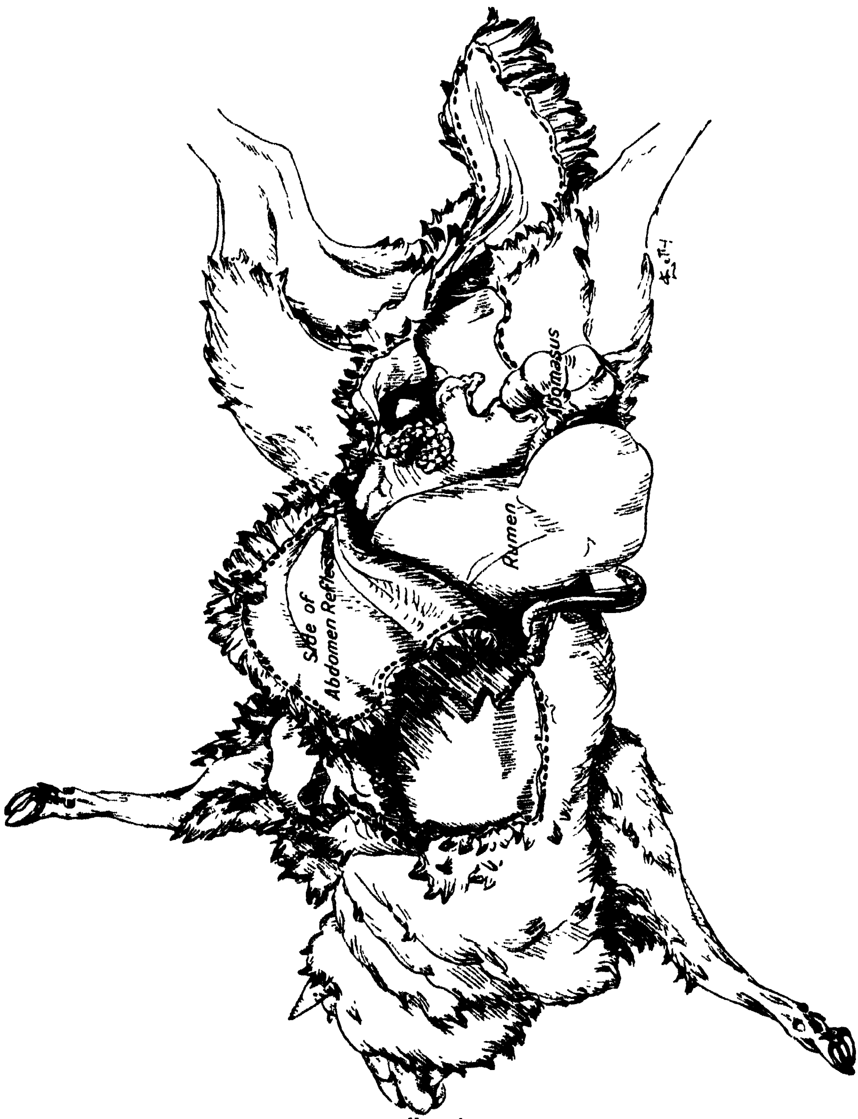


Fig. 2.

(4) *Necessary Information.*—Give a short description of the disease on the farm. Consider, for example, date of the outbreak; number of animals on the farm; number of animals dead from the disease; age, breed, sex; some of the important symptoms, etc.

Fig. 3.

Fig. 4.
Arrow marks opening of bile duct into small intestine.

(5) *External Peculiarities of the Carcass*, e.g. kind of animal, age, sex, colour, breed, condition of the carcass (e.g. if emaciated or in good condition), peculiarities in connexion with the skin, the body, the limbs, etc.

(6) *Manipulations*.—In order that the description of the method of procedure be made as simple as possible, the accompanying illustrations have been prepared, and indicate more or less the different stages of the post-mortem and the most important organs.

Allow the animal to lie on its right side; remove the udder in the female or external genital organs (penis) in the male by an incision along the line *a*, fig. 1; cut away the fore-limb by the incision along line *b*, fig. 1, and open up the abdominal cavity by an incision along the line *c*, fig. 1. By pulling the flap at the point *d*, fig. 1, the greater part of the abdominal cavity will be exposed as in fig. 2.

Diagram to indicate the organs after removal of the right side of the abdominal cavity of a bovine.

1, Large intestine. 2, Small intestine. 3, Abomasus. 4, Gall bladder. 5, Liver. 6, Kidney (right). 7, Pancreas.

Notice the presence of fluid in this cavity. If any, give its amount more or less, its colour, etc. Note whether the covering of the organs and intestines is smooth and glistening, the presence of fat, the distension of the intestines with gas, etc.

Proceed to open the thoracic cavity by making an incision along the fleshy portion of the diaphragm as indicated by the line *a* in fig. 3 (another view of the diaphragm is given in fig. 8). Cut or saw through the sternum (or breastbone) as indicated by the line *b*, fig. 3, and saw through the upper extremities of the ribs, as indicated by the line *c*, fig. 3.

That will allow the whole of the left side of the thorax to be removed. Note the presence of any fluid in this cavity; if any, give its amount, colour, etc. This is of importance, for instance, in cases of heartwater.

(7) *Removal of the Organs of the Abdominal Cavity and their Examination.*—(*a*) Proceed with the removal of the four stomachs and spleen by cutting through the oesophagus (gullet) as it passes through the diaphragm, and the small intestine at its commencement, i.e. at a point *a*, fig. 4. By careful traction and dissecting the rumen away from the wall of the abdominal cavity, it will be found that the stomach can easily be removed.

Examine the four stomachs as regards their contents, the appearance of the lining of the interior, etc.

N.B.—Be careful to note the presence of parasites (wire-worm) in the fourth stomach (abomasum or melkpens) (see fig. 4). In case of suspected poisoning be careful to collect some of the contents

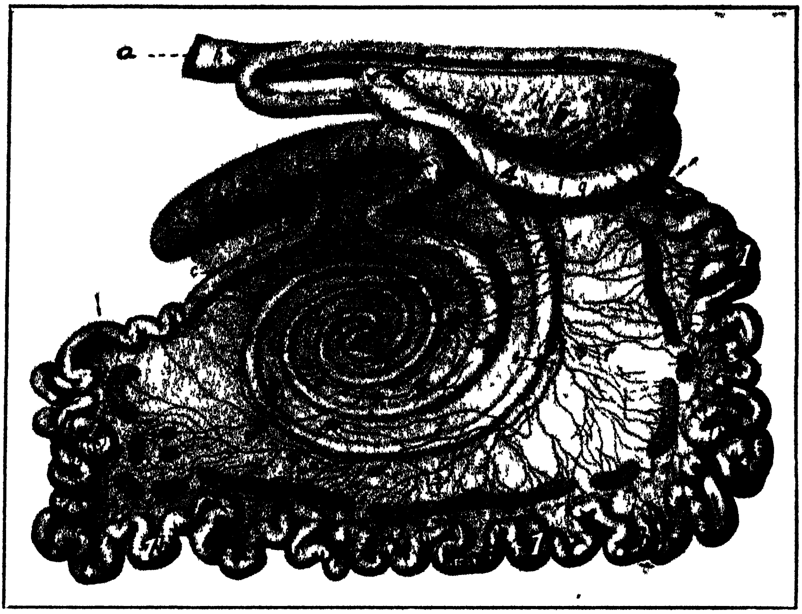


Fig. 6.

Diagram to show position of mesenteric lymphglands.

1, Small intestine. 2, Glands (mesenteric lymphglands). 3, Caecum. 4, Large intestine. 5, Pancreas. *a*, Rectum.

from the rumen and fourth stomach into a clean vessel for analytical purposes. Examine the spleen. It is always advisable to make smears from this organ.

(*b*) Proceed with the removal of the intestines. This is rather complicated, and to give farmers some indication of the organs, photographs have been made. These are shown in figs. 5 and 6.

The best method to adopt would be to cut the large intestine at a point *a*, figs. 5 and 6, where it passes on as the rectum. From this point carefully dissect out and remove all the intestines in bulk, i.e. working from the back forwards.

With the help of fig. 6 the operator will be in a position to identify the various parts of the intestine. By cutting along the dotted line in fig. 6 the small intestines can be removed from the large intestines.

Examine each portion in turn as regards contents, character of the lining of the interior, the presence of parasites, etc.

N.B.—In small ruminants pay particular attention to the occurrence of nodular worms and nodules in the large intestine (see No. 4, fig. 6).

(*c*) Remove the liver by carefully severing it from the diaphragm. Note its size, shape, colour, the presence of nodules, white areas, cysts, abscesses, the presence of parasites in the bile-ducts, etc.

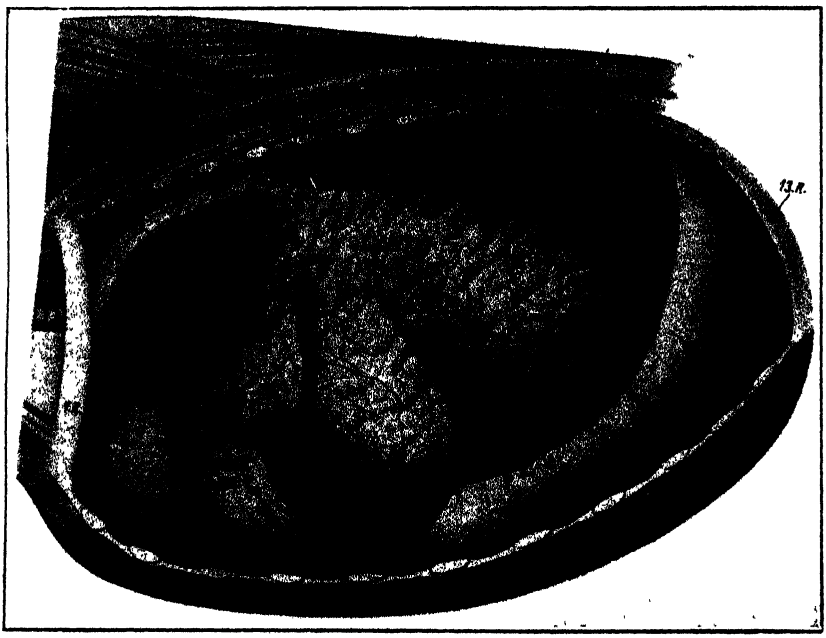


Fig. 7.

Diagram to indicate position of the lungs after the removal of the left thoracic wall.

N.B.—If specimens are to be collected for laboratory examination, always include a piece of liver. In the case of suspected poisoning, a piece of liver (4 oz.), either without preservative or preserved in methylated spirits, should also be sent. Note the gall-bladder, its contents and size.

(*d*) Remove the kidneys, and note the amount and character of the fat around the kidneys; size, shape, and colour of kidneys.

Examine the urinary bladder, and note the character and amount of urine. In redwater and biliary fever the urine is usually of a reddish or port-wine colour.

(8) *Removal of the Organs of the Thoracic Cavity and their Examination.*

(*a*) Be careful to examine the lymph glands (see fig. 8), especially in bovines, by cutting into them and noting the occurrence of any yellowish centres. These glands are commonly affected in cases of bovine tuberculosis.

(*b*) Before the removal of the left lung, examine the pericardial sac (heart sac) and heart.

Make a slight incision (see dotted line, fig. 7) into the heart sac, and note the presence of fluid. If any, note its amount, character of contents, etc.

Remove the heart by cutting through the large blood-vessels (see fig. 8), by which it is suspended. Examine the exterior and interior of the heart. Note its lining and contents.

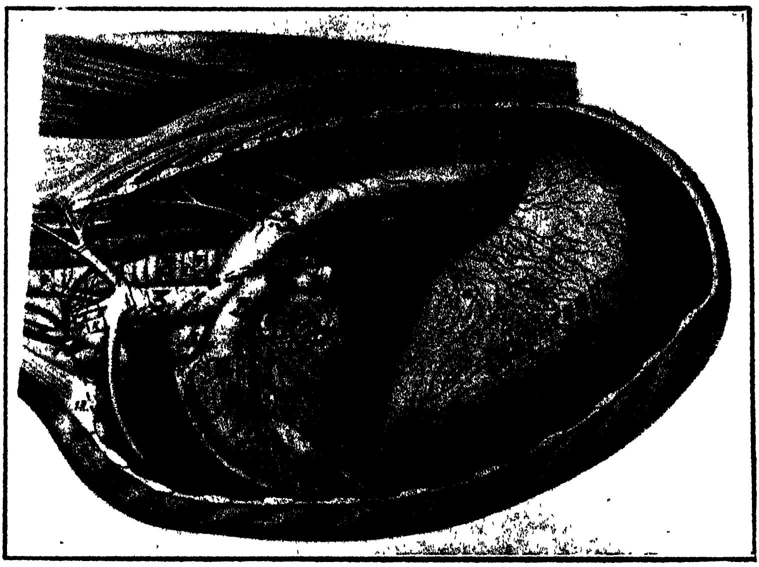


Fig. 8.

Same as Fig 7, with lung removed.

1, Mediastinal lymphglands. 2, Trachea (windpipe). 3, Large bloodvessels.

(*c*) Remove the left lung and then the right lung by cutting through their bronchi (i.e. the windpipes). Examine the lungs as regards their elasticity, inflation, colour, shape, whether the lung floats or sinks in water, presence of cysts and parasites, etc.

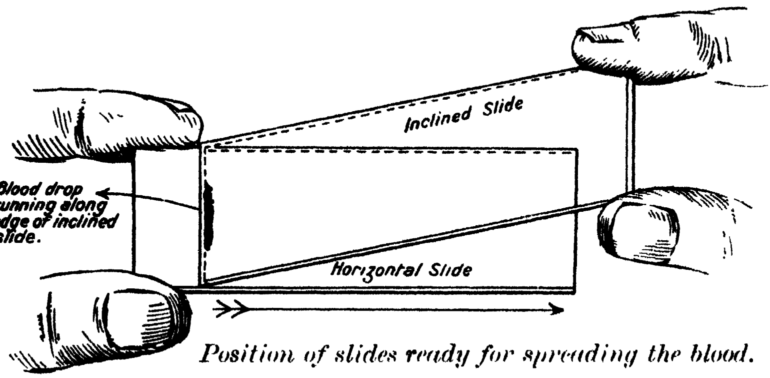
(9) *Removal of the other Organs*, i.e. tongue, pharynx, larynx (throat) trachea (windpipe), and oesophagus (gullet). Open these and note contents, character of the lining. Cut into the fleshy portion of the tongue, and note the presence of parasitic cysts (measles) in bovines and pigs, etc.

The first thing to be done is to prepare the glass-slides on which the blood is to be spread. The glass should be thoroughly cleaned, kept free from dust, and should be polished with a cloth or handkerchief immediately before use. A number of slides may be cleaned at one time and kept wrapped up in paper ready for use.

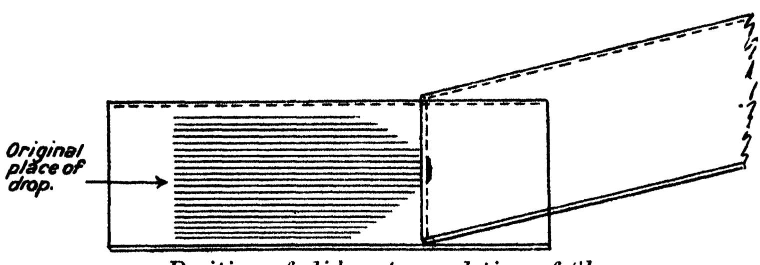
To make the film, hold the slide in the left hand by placing the thumb and forefinger on the edges of one end; with one of the corners of another slide place a small drop of blood on the flat surface of the finger-end of the first slide. Then take a second slide between the thumb and forefinger of the right hand, place its free end over the blood-drop in such a way that the two slides form an acute angle wherein the drop of blood lies. When the second slide touches the drop of blood, the latter will run along the edge of the slide. By immediately drawing the inclined slide along the horizontal one, the required thin film of blood will result (see fig. 9).

Where proper slides are not available, any piece of plain, transparent glass may be used after thorough cleaning and drying.

HOW TO MAKE BLOOD AND ORGAN SMEARS.



Position of slides ready for spreading the blood.



Position of slides at completion of film.

Fig. 9.

Scrapings from the organ made with the short edge of the slide can be drawn over the horizontal slide in the same manner.

It is very easy to spoil a smear by making it too thick, and the film should always be made as thin as possible. A rough way of ascertaining whether the blood-film is too thick or not is to hold the slide with the blood-smear on it up to the light, and if the colours of the rainbow can be seen on the glass, the film can be considered as being thin enough.

When the smear has been made, allow the blood on the glass to dry in the air, but not in direct sunlight. When the blood is dry, wrap each glass in a small piece of thin paper before placing it in the envelope.

N.B.—In no circumstances attempt to send *wet* smears—slides stick together like a sandwich.

COLLECTION OF MATERIAL FOR LABORATORY DIAGNOSIS.

(*a*) Obtain the material as fresh as possible from the carcass. Remember that in a couple of hours decomposition may be so advanced that the material becomes absolutely useless for examination.

(*b*) Do not, under any circumstances, send material without some preservative (except in cases of suspected poisoning, when stomach contents should be sent in a clean glass jar without the addition of a preservative).

(*c*) The best and cheapest preservative to use for specimens is formalin (1 part formalin and 9 parts of ordinary tap water). It can be procured at any chemist. In case of emergency, specimens

Fig. 10.

a, Bowel scissors. *b*, Butcher's knife. *c*, Specimen bottle with crystal clear 10 per cent. formalin solution. *d*, Canned-fruit jar with crystal clear 10 per cent. formalin solution. *e*, Wooden box for specimen bottle *c*. *f*, Wooden block to indicate the *maximum size* of material to be collected.

may be inserted in brandy and spirits of wine, but this is far from satisfactory. Failing the above preservatives, one may attempt to wrap specimens in a pack made of muslin and steeped in strong brine; but this is most unsatisfactory.

(*d*) Parasites can be forwarded in alcohol.

(*e*) It is essential that the pieces of material to be collected for examination should be handled as little as possible, and should in no circumstances exceed ½ square inch and ¼ inch thick (see fig. 10).

(*f*) A couple of these pieces should be dropped into the preserving fluid. Do not overcrowd the vessel or container with specimens. There should be at least ten times as much preservative fluid as there is material.

(*g*) The best vessels for such specimens are small canned-fruit jars (see fig. 10), which can easily be made water-tight. On application to the Director of Veterinary Education and Research, P.O. Laboratory, Pretoria, suitable bottles containing preservative (see fig. 10) will be sent to any part of the Union free of cost for the collection of suitable material.

DISPATCH OF SMEARS AND SPECIMENS.

(*a*) Blood and organ smears should be wrapped in a paper and placed in an envelope addressed to the Director of Veterinary Education and Research, P.O. Laboratory, Pretoria. Better still, the smears can be packed with the specimens and labelled "Smears."

(*b*) The glass jars should be securely packed in a wooden box, preferably in sawdust, and railed "Carriage forward" to the Director of Veterinary Education and Research, Pretoria North Station.

(*c*) In order that the specimen be correctly identified on its arrival at the laboratory, the name and address of the sender should appear on the label or, better still, a paper giving the particulars should be enclosed in the box.

(*d*) In case of suspected poisoning, the bottle containing the stomach contents and liver should be marked "Suspected poisoning."

CITRUS CANKER ERADICATION.

INSPECTION WORK, DECEMBER, 1925.

Farms Inspected—

Rustenburg District (*Hex River Ward*).—Buffelspoort No. 668, Boschfontein No. 193, Buffelshock No. 900, Elands Drift No. 248, Groenkloof No. 418, Bokfontein No. 647, Boschfontein No. 381, Waterkloof, No. 4.

Pretoria District (*Crocodile River Ward*).—De Kroon No. 420, Roode Kopjes No. 44, Moselakatznek No. 379, Sandspruit No. 379, Roodekopjes No. 132, Greylings Post No. 111. (*Aapies River Ward*) Klipdrift No. 123, Schoongezicht No. 144.

Waterberg District (*Nylstroom Ward*).—Roodepoort No. 2148, Noodshulp No. 329, Buffelspruit No. 1920, Elandsfontein No. 1782, Buiskop No. 1532, Vischgat No. 2121, Middelfontein.

Fresh infections on farms previously reported infected.—Nil.

Fresh outbreaks.—Nil.

Total number of nursery stock inspected.—1,787.

Total number of trees inspected.—10,559.

Total number of trees found infected.—Nil.

Total number of inspectors engaged.—14.

BUSHEL WEIGHTS OF NATAL-GROWN SEEDS.

By M. EDELMAN, C.D.A., Lecturer in Field Husbandry, School of Agriculture, Cedara.

THE accompanying bushel weights of Natal-grown seeds were taken by the writer at the Natal Agricultural Shows at which he judged during 1924 and 1925.

The bushel weight, that is the weight of a certain measure of seed, may form a very useful guide to the farmer in more directions than one. In the Union, the bushel weight, as a standard, is only used in one or two instances, e.g. in the grading of oats. In other countries, returns of different crops, rate of seeding, and the grading of grains, are all based on a definite recognized bushel weight standard. As an outstanding example of its usefulness, the official grain-grading standards of the United States of America are of great interest.

The real value of the bushel weight of any particular variety of seed lies in the fact that it serves to illustrate points of the highest importance, particularly in so far as quality is concerned. Take, for example, maize. If this registers a very low bushel weight, the kernels are then of inferior quality, not only from a seed standpoint but from a marketing or commercial point of view also. A low bushel weight is generally recorded by a sample of seed that may be either diseased, wet, burnt by over-heating, or immature. These are very undesirable conditions from every aspect.

In the judging of certain varieties of maize, however, the weight per bushel must by no means form the limiting factor. Other things being equal, it will be found that large kernels weigh less per bushel than the smaller grains, and in so many cases (depending on the variety) large seed is preferred to other kinds.

Where bushel weights are fixed for the seeds of different crops, the farmer has something definite to go by, and is thus more or less safeguarded in the purchasing or disposing of seeds and other grains. Bearing in mind that in the past, and even at the time of writing, there has been so much discontent experienced by buyers of seed, the importance of adopting the bushel-weight measure as a standard is worthy of very careful consideration by the farming community. A similar standardization work in the other Provinces would be a great asset in fostering the perfection of seed grading.

BUSHEL WEIGHTS OF NATAL-GROWN SEEDS, 1924 AND 1925.

Name and Variety.	Average Bushel Weight in lb.	
	lb.	Variation.
Maize—Hickory King	53	Plus or minus 2 lb.
Potchefstroom Pearl	55	" " 2 "
Natal White Horsetooth	55	" " 3 "
Ladysmith Pearl	53	" " 1 "
A.O.V., White Dent	55	" " 2 "
White Flint	56	" " 6 "
Chester County	58	" " 3 "
Natal Yellow Horsetooth	56	" " 2 "
Natal 8-row Yellow Flint	61	" " 2
Kaffir Corn—Red	62	" " 1 "
Pink	61	" " 1 "
White	61	" " 1 "
Barley	46	" " 1 "
Wheat	61	" " 3 "
Oats—Sidonian	35	" " 3 "
Winter Dun	43	" " 1 "
Algerian	34	" " 5 "
A.O.V.	33	" " 4 "
Rye	53	" " —
Beans—Canadian Wonder	61	" " 1 "
Small White Kidney	62	" " 3 "
Natal Yellow Dwarf	62	" " 2 "
Small White Haricot	65	" 1 "
Sugar	60	" " 2 "
Large White Kidney	56	" " 1 "
A.O.V.	64	" " 3 "
Soya Beans—Brownie	57	" " 1 "
Chinese White	58	" " 1 "
Mammoth	56	" " 1 "
Cowpeas—Mixed	59	" 3 "
New Era	61	" " 1 "
A.O.V.	59	" " 2 "
Peas—Smooth	61	" " 1 "
Wrinkled	55	" 2 "
Millet—Japanese	36	" " 2 "
Golden	55	" " 2 "
Buckwheat	50	" " 3 "
Sunflower—Black	32	" 2 "
(Black) Striped	29	" " 3
Linseed	54	" " 3 "
Ground Nuts (Unshelled)	19	" " 1 "
Teff	69	" " 1 "
Ryegrass, Perennial	22	" " 2 "
Cocksfoot	12	" " 1 "

The figures in this table were obtained by weighing all the samples of the various grains shown on most of the important Natal Agricultural Shows in 1924 and 1925.

WART DISEASE OF POTATOES
(*Synchitrium endobioticum* Perc.)

By E. M. DOIDGE, M.A., D.Sc., F.L.S., Assistant Chief, Division of Botany.

WART disease is rightly regarded as one of the most serious and destructive diseases to which the potato is subject. This is not only on account of the severe damage which it may cause to any individual potato crop, but because of its long persistence in the soil and its tendency to spread gradually over ever-increasing areas.

OCCURRENCE.

The origin of this most destructive disease of potatoes is not known with any degree of certainty. It has been known in Great Britain since the last decade of the nineteenth century, and has spread gradually until it has been recorded from nearly every county of England. Scotland has a considerable amount of the disease, especially in mid-Scotland and the south, and it is also known in limited areas in Ireland. Wart disease is spreading on the continent of Europe and is now known to occur in most of the countries. It was introduced into the United States in the years 1911 to 1912, when a serious shortage in the potato crop led to the importation of several shiploads of potatoes which were distributed in Pennsylvania and adjacent States. In all these countries legislation is in force with a view to preventing the further spread of the disease.

Since 1912 there have been restrictions on the importation of potatoes into the Union of South Africa as a safeguard against the introduction of seed infected with wart disease. It is required that every consignment be accompanied by two certificates—(1) a sworn declaration clearly establishing the locality in which the potatoes were grown and (2) a certificate from the Department of Agriculture of the declared country—certifying that wart disease has not occurred within five miles of that locality. As an additional precaution the potatoes are also inspected at the port of entry.

The first occurrence of wart disease in South Africa was in 1922, when two small plots were found infected in Natal. These were fortunately on stock farms in the Impendhle District, where potatoes were only grown for home consumption and none had been sent to the market. Every effort was made to trace the origin of this outbreak, but without success, and the most rigid inspection failed to reveal any further cases of infection. The farms on which wart disease was found were quarantined. The owners were allowed to plant only immune varieties on a new site, and the old garden was thoroughly disinfected with sulphur. No potatoes may be removed from these farms.

No further case of wart disease was noted until November, 1925, when it made its appearance in a small holding at Hamberg, in the neighbourhood of Johannesburg, the owner admitting that the disease had been noticed the previous season, but that it had not been reported. It was stated that the seed had been purchased on the open market. A thorough inspection of all the market gardens in the vicinity of Johannesburg was at once instituted, and up to the time of writing wart disease has been found on three adjoining plots at Hamberg and one at Witpoortje. The potato crop in these gardens is estimated at approximately 1,000 bags, mostly of the Up-to-Date variety. All these gardens have been placed in quarantine, and no potatoes may be removed from them without the permission of the Minister of Agriculture. This is a precautionary measure pending the completion of the present inspection, when the policy of the Government with regard to wart disease can be definitely formulated.

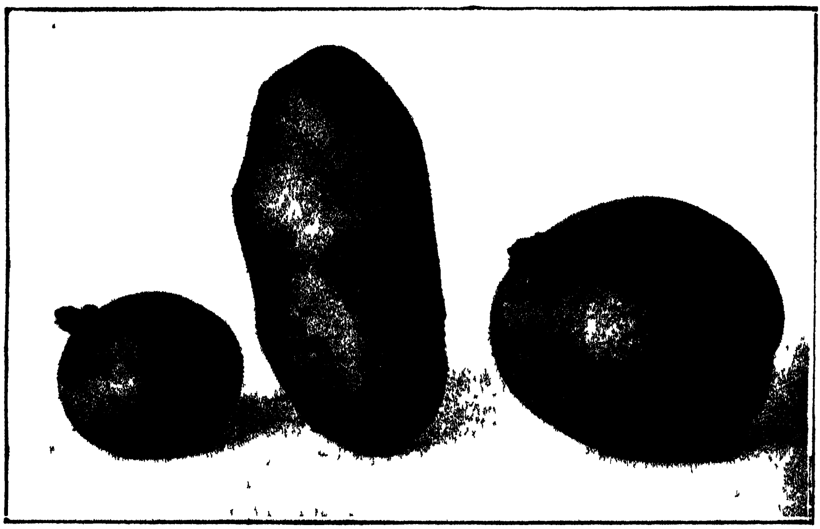


FIG. 1.

APPEARANCE OF THE DISEASE.

Wart disease is caused by a soil organism which attacks the tender underground portions of the potato plant and occasionally the stalks where they come in contact with the soil. The fungus does not arrest the growth of the plant—an affected plant looks perfectly healthy and if anything stronger than its neighbours, but on moving aside the shoots a spongy or corrugated mass of yellowish-green tissue may be found arising from the stems near or under the ground. These growths later turn dark brown or black, except where they have pushed up out of the soil and become greened, as any potato will do when exposed to the light.

The tubers are attacked at the eyes, and sometimes the only evidence of the disease is a group of very minute excrescences at the eyes, which in consequence appear discoloured or blackened. A case of this kind and some slightly larger warts are shown in Fig. 1. There

is great variation in the size and number of the warts, but as a rule these grow into large, wrinkled, warty excrescences (Fig. 2), which may be larger than the original tuber. If the tuber is attacked when it is quite young, normal growth is completely stopped and the whole potato is turned into a wrinkled, misshapen mass (Fig. 3) which soon decays or dries up.

In dry seasons, very often only the potatoes in the immediate neighbourhood of the stem are attacked; those formed on the underground branches at some little distance are only slightly affected or apparently not at all. In wet seasons, however, the progress of the disease is more rapid. The warts are formed earlier and the tubers often become completely decayed. In some cases, when the stalk has been pulled out without much force being exerted, the ground when dug has revealed nothing but a black, semi-liquid mass of saturated earth with no tuber at all.

FIG. 2.

OTHER PLANTS AFFECTED.

The possibility of the infection of other solanaceous plants by the wart disease organism has been investigated in detail during the last few years by many workers. The susceptibility of the tomato to infection was established in 1919, but infection is much less severe than in the case of the potato, and only certain varieties are attacked. Of the numerous solanaceous weeds which have been tested, only two species of *Solanum*—*S. nigrum* and *S. dulcamara*—are susceptible. Other species of *Solanum*, *Datura* (stinkblaar), *Physalis*, *Capsicum* (peppers), and tobacco all proved resistant to infection.

CAUSE OF THE DISEASE.

If the cut surface of a wart be examined with a hand-lens, reddish-brown lines may be detected just under the skin, and they consist of numbers of reddish-brown sporangia of the fungus *Synchytrium endobioticum* Perc. (Fig. 4), which are too small to be seen with the naked eye. They are formed in immense numbers in the outer layers of the warted tissue and are of two kinds—(*a*) summer sporangia

and (*b*) resting sporangia. The summer sporangia, if conditions are favourable, soon open to set free a large number of motile spores which are capable of infecting other parts of the plant, and of thus producing new warts within a short time. These motile spores, however, are capable of moving only a short distance in the soil, so that the spread of the disease to new plants or over a large area by spore movement is not rapid. The chief danger lies in the dissemination of the thick-walled resting sporangia which are released into the soil when the warty mass rots. These may be dormant for long periods, and though a great number germinate each year, it is apparent that some of them lie dormant for five or possibly ten years.

HOW THE DISEASE SPREADS.

The spread of wart disease may be brought about through any agency by which the live sporangia of the fungus may be transferred from place to place.

The most obvious of such agencies, and the most dangerous, is the distribution of potatoes grown in infected soil. Seed potatoes from such soil are capable of spreading the disease, even when they are apparently sound, owing to the presence of sporangia on their surface or in soil adhering to them; and table potatoes, though they be consumed, are also a dangerous source of infection, since their peelings and wash-water are capable of spreading the disease to garden or field. Manure is also a very dangerous material, since it is so likely to contain refuse from gardens or potato peelings, and may even contain sporangia derived from raw potatoes fed to animals. It has been definitely proved that these bodies can be passed through the digestive tract unharmed.

All vegetables and root crops, or any young-rooted plant, such as cabbages and tomatoes, may be a means of spreading wart disease, since spores are readily carried in the adhering soil; and used bags, baskets, and other containers may also be a source of danger.

Wart disease may also be spread by earth adhering to implements and to the shoes of men moving from one plot to another. The surface flow of storm-water and of irrigation water is also a factor to be considered.

THE CONTROL OF WART DISEASE.

The fact that wart disease is caused by a soil organism immediately suggests several possible lines of control, such as (1) the prevention of the spread of the disease by suitable quarantine methods, (2) starving out the organism by a long crop rotation, (3) soil disinfection, and (4) the propagation and cultivation of immune varieties.

(1) All sites where the disease is known to exist have been put in quarantine, and a general policy will be evolved as soon as the extent of the infection is more fully known. This will possibly be along the lines of proclaiming "restricted areas" in the sense of Government Notice No. 912 of 1922 (q.v.). No movement of potatoes is permitted from restricted areas to places outside such areas, and planting of potatoes is only permitted under permit, and is limited to the planting of approved immune varieties.

(2) The question of starving the organism, by a long crop rotation from which potatoes and tomatoes are omitted, is hardly worth considering where land is valuable, owing to the extremely long persistence of the sporangia of *Synchitrium endobioticum* in the soil. Plots grassed down for six years have still produced warted potatoes when they were again planted with this crop.

(3) The possibility of soil disinfection may also be ruled out as impracticable where large areas are involved.

Experiments carried out a Rothamstead and elsewhere in soil disinfection with sulphur have given promising results, but the cost of such operations is prohibitive when it comes to field practice.

(4) The most promising line of prevention and control is the cultivation of immune varieties. Fortunately, during the extended investigations into wart disease which have been carried out in Great Britain and elsewhere, a large number of varieties have been dis-

FIG. 3.

covered which are immune to wart disease, and which remain entirely free of infection even when grown in soils which are thoroughly infected with *Synchitrium endobioticum*.

Several of these varieties were imported in 1922, namely:—Crusader, Majestic, Tinwald Perfection, Kerr's Pink, and Golden Wonder. They were tried in badly infected soil in Natal, and were found to retain their immunity under local conditions. All these varieties remained quite sound, while Up-toDate volunteers on the same ground became badly diseased. Unfortunately, the seed arrived in this country in poor condition and did not produce a crop adequate for distribution. Later, the British Department of Agriculture was asked to recommend immune varieties for trial in South Africa, and nine varieties were imported on their recommendation, namely:—(First Early)—Witchill, Immune Ashleaf, Dargill Early. (Second Early)—Ally, Great Scot (Main Crop), Tinwald Perfection, Kerr's Pink, Majestic, Rhoderick Dhu.

These were grown successfully and the first crop distributed to the agricultural schools for propagation and report. Very little information is yet available as to the behaviour of the varieties under local conditions, but it is certainly desirable that they should be fully tested and that from them suitable varieties for general purposes be selected. It will then be possible to replace to a large extent the susceptible Up-to-Date variety which is so largely grown at present.

LEGISLATION BEARING ON WART DISEASE IN POTATOES.

(i) *Extracts from the Agricultural Pests Act*, 1911 (*No.* 11 *of* 1911).

2. (Interpretation of terms.) "Officer" shall mean an officer of the Department (of Agriculture) to whom the Minister has in writing either generally or specially assigned duties under this Act.

"Plant" shall mean any tree, shrub, or vegetation, and the fruit, leaves, cuttings, or bark thereof, and shall include any live portion of a plant whether severed or attached.

"Plant disease" shall mean any bacterial or fungus or other disease which is injurious to plants.

14. The Governor-General may by proclamation in the *Gazette*—

(*c*) prohibit or restrict the removal of any plant from one place to another within the Union for the purpose of preventing the spread of any insect pest or plant disease;

(*d*) prohibit or restrict the introduction into the Union of any plant from any specific country or place.

15. The Minister may, in writing, empower generally or specially any officer to enter upon any premises, other than a nursery, and inspect the same and ascertain by exposing the roots of plants . . . or otherwise, whether there is any . . . plant disease, and if any such officer suspect or discover upon any such premises the existence of any plant disease, he may by notice in writing to the occupier of the premises, stating the nature of the disease, declare the whole or any part of the premises to be quarantined for a definite or indefinite period.

27. (11) Any person who is guilty of an offence against this Act, or any Proclamation issued thereunder, or the regulations . . . shall be liable on conviction to a fine not exceeding fifty pounds or in default of payment to imprisonment with or without hard labour for a period not exceeding six months.

(ii) *Extract from Government Notice No.* 366 *of* 1912, 15*th March*, 1912 (*as corrected by Government Notice No.* 877 *of* 1912).

12. (1) No person shall introduce or cause to be introduced into the Union from oversea or from any territory in South Africa which is not a British possession or protectorate any potato tubers, the introduction of which the Department considers undesirable by reason of the presence therein or theron of any rot, decay, scab, or other blemish deemed by the Department to be due to an insect or a parasitic organism likely to be introduced with affected tubers.

The Department may cause to be sorted at the expense of the owner all consignments of potatoes which arrive at any port for introduction into the Union.

The Department may reject all potatoes the introduction of which is found on such sorting to be undesirable.

(2) No person shall introduce or cause to be introduced into the Union from oversea or from any territory in South Africa which is not a British possession or protectorate any consignment of potatoes unless he produces and delivers up to an officer—

(*a*) a statement on oath from the consignor declaring the country and particular place or places thereof in which the potatoes were grown and giving data clearly establishing the identity of the consignment; and

(*b*) a certificate from the Department of Agriculture of the declared country, or a certificate from some official institution of that country which the Minister has agreed to

FIG. IV.—Photomicrograph of part of Section through a Diseased Tuber, showing the spores of *Synchitrium endobioticum*, Perc.

recognize in lieu of such Department, certifying at a date not more than thirty days before the time of the despatch of the consignment that the disease known as black scab or warty disease (*Synchitrium endobioticum* Percival) has not been known to exist, so far as it is aware, within five miles of the place or places in which the potatoes are declared to have been grown.

(iii) *Extract from Government Notice No.* 917 *of* 1913.

(1) No person shall introduce or cause to be introduced into the Union any articles contained in any consignment of potatoes which appear by the evidence of accompanying documents, or by being

contained in similar boxes, bags, or other receptacles to have originated in the same district or such-like territorial area as an article contained in the consignment found to be infected with black scab or warty disease (*Synchitrium endobioticum* Percival).

(iv) *Proclamation No.* 90 *of* 1922.

Whereas wart disease on potatoes (*Synchitrium endobioticum* Perc.) being a plant disease in terms of Act No. 11 of 1911 has been found to exist in the areas enumerated in the Annexure hereto; and whereas it is deemed necessary to impose restrictions for the prevention of the spread of the disease;

Now, therefore, under and by virtue of the powers in me vested by paragraph (*c*) of section *fourteen* of the Agricultural Pests Act, 1911 (Act No. 11 of 1911), I do hereby declare, proclaim, and make known that the prohibition and restrictions set out in the Annexure hereto shall exist in respect of the removal of plants therein named, to the extent therein provided.

Any person guilty of a contravention of any such prohibition, or a failure to comply with any provision of this Proclamation with which it is his duty to comply, will under section *twenty-seven* of the said Act be liable to the penalties in that section mentioned according to the circumstances therein set forth.

Annexure.

1. For the purposes of this Proclamation the following are declared to be restricted areas:—

The farms Castle Howard and Killaloe in the Impendhle Division, Pietermaritzburg County, Natal.

2. No person shall remove or cause to be removed, except with the special permission of the Minister of Agriculture, any potato tubers or any parts of potato plants from any place within the restricted area to any other place either within that area or outside thereof. The regulations published under Government Notice No. 912 of 1922 shall apply to the said area.

(v) *Government Notice No.* 912 *of* 1922.

For the purpose of dealing with the outbreak of wart disease in potatoes in the areas restricted by Proclamation No. 90 of 1922, His Royal Highness the Governor-General has been pleased in terms of section *twenty-eight* of Act No. 11 of 1911 to make the following regulations:—

Regulations.

1. No person shall deal in, or have in possession, or use for planting in land which is not a restricted area under Proclamation No. 90 of 1922, any potatoes which have to his knowledge been grown in the said area, unless such potatoes shall have been removed from that area under special permission granted under the said Proclamation and are contained in unbroken case or crate or bag.

2. No person shall plant or cause to be planted in the said area any potato tubers without a written permit from an officer appointed by the Minister of Agriculture.

3. A notice from the said officer may require the owner or occupier, or any other person in charge of the said area, to adopt one or more of the following measures, viz.:—

(a) To destroy any part of the crop of potatoes, except the tubers, by fire or such other suitable method as may be specified in the notice.

(b) To boil thoroughly all diseased tubers.

(c) To take such other steps as the before-mentioned officer may consider necessary to prevent the spread of the disease.

4. Any such notice may appoint the time within which the adoption of any measure thereby presented shall be completed.

5. Tubers visibly affected with wart disease shall in no circumstances be sold, or offered for sale, exchanged or donated by any person on a restricted area.

6. No person shall remove, or cause to be removed, except with the special permission of the officer aforesaid, any kraal or stable manure from any place within the area restricted under the said Proclamation to any other place within or outside that area.

7. Contraventions of these regulations are punishable under section *twenty-seven* of Act No. 11 of 1911.

Acknowledgment.—In compiling this bulletin I have drawn freely on previous publications, and especially on General Bulletin No. 394, Pennsylvania Department of Agriculture, "Potato Wart," by R. E. Hartman and W. A. McCubbin.

DYNAMOMETER TESTS AT POTCHEFSTROOM.

II.

By W. S. H. CLEGHORNE, D.Sc., M.I.Mech.E., Agricultural Engineer, School of Agriculture and Experiment Station, Potchefstroom.

THE following is a digest of the trials carried out at the Experiment Station, Potchefstroom. It may be considered as a continuation of the article "Dynamometer Tests at Potchefstroom" which appeared in the *Journal of the Department of Agriculture*, March, 1924, and in which trials Nos. 1, 2, and 3 of the present paper were described more fully, such points as the horse-power at which the oxen worked and the speed of ploughing having been dealt with.*

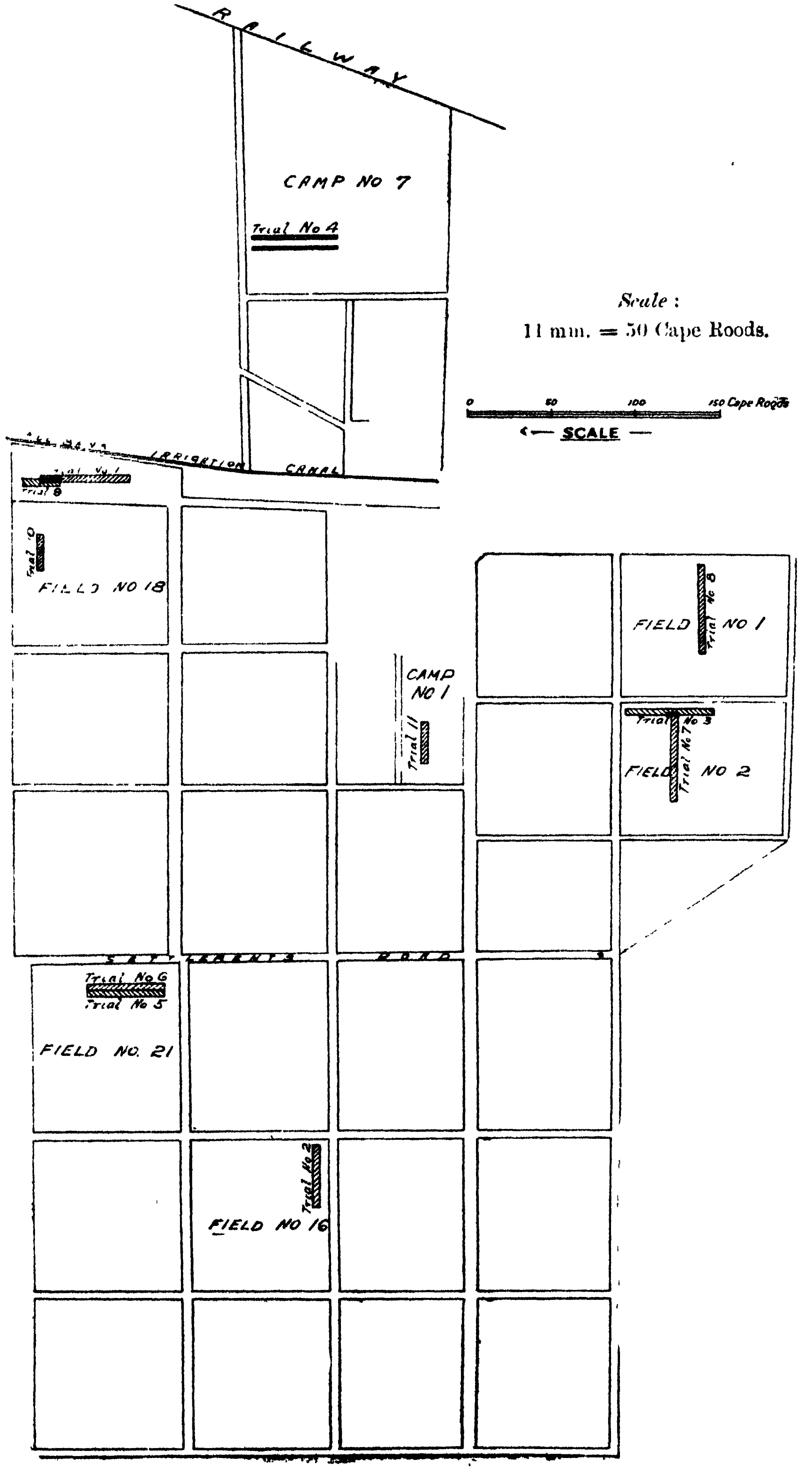
No very systematic arrangement of the trials was possible, since they had to be carried out to fit in with the routine farm operations, and were thus made in whatever field these operations left available at the moment. All the ploughs used in the trials here described were new or practically new; hence the results are not complicated or obscured by the effects of wear, or by the deformation that is so often present in an old plough.

The adjoining table presents in concise form the data obtained, and the location of each of the trials is clearly shown in the accompanying plan.

* Dr. Cleghorne has written another paper on the same subject, entitled "Yoking Oxen to the Plough: A New System." It has been forwarded for publication in the *Transactions of the Royal Society*. The accuracy of the dynamometer and the suitability of the use of the combination, draft animals-dynamometer-plough, in order to record and measure variations in soil resistance or soil texture, are discussed in the first part of this paper.—EDITOR.

Trial No.	Place.	Pull per Square Inch of Furrow-slice.	Mean Depth of Ploughing. Inches.	Condition of Soil.	Remarks.
1	Top of Field No. 18	11·5 lb. in the heavy soil; 7·2 lb. in the light soil	6·87	In fair ploughing condition, but on dry side; had not been ploughed for six months before date of trials	Mean of twelve tests with three new mouldboard two-furrow ploughs, viz., the "Koodoo," "Prince," and "Bulldog." The S.W. end of the strip ploughed was in lighter soil than the N.E. end. Twelve oxen were used in each plough.
2	Field No. 16	7·53 lb.	8·36	In good ploughing condition, but packed on mouldboards and discs. Had not been ploughed for twelve months before date of trials	Mean of four tests with a two-furrow "Prince" plough. Twelve oxen were used.
	Do.	7·34 „	5·75	Do. do.	Mean of four tests with a three-furrow "Defiance" (Ransome's) disc plough. Twelve oxen were used.
	Do.	6·13 „	5·20	Do. do.	Mean of two tests with the mouldboard plough ran at approximately the same depth as the disc plough.
3	Field No. 2	6·36 „	8·48	Dry and hard	Mean of four tests with a two-furrow "Prince" mouldboard plough with fourteen oxen.
	Do.	8·84 „	8·28	—	Mean of four tests with a three-furrow "All Conqueror" Ransome's disc plough with fourteen oxen.
	Do	8·84 „	8·28	Dry and hard	The disc plough pulverized the ground much better than did the mouldboard plough and left it fit to be dealt with by a disc harrow.
4	Camp No. 7	7·07 „	6·40	In good ploughing condition. Ploughs did not scour. Had not been ploughed for twelve months before date of trial	Mean of eight tests: four with a "Bulldog" two-furrow mouldboard plough and four with a "Koodoo" two-furrow mouldboard plough. Twelve oxen were used. Trials were carried out on the chemistry rotation plots (across the two uppermost rows of plots).
5	Field No. 21	4·52 „	6·83	In good ploughing condition	Mean of two tests with a "Prince" three-furrow mouldboard plough.

Trial No.	Place.	Pull per Square Inch of Furrow-slice.	Mean Depth of Ploughing. Inches.	Condition of Soil.	Remarks.
6	Field No. 21	6·45 lb.	7·29	Ground rather wet. It packed on the mouldboards, i.e. the plough did not scour	Mean of two tests with a "Prince" three-furrow mouldboard plough.
7	Field No. 2	5·98 „	5·88	In good ploughing condition	Mean of two tests with a "Prince" three-furrow mouldboard plough with twelve oxen.
8	Field No. 1	8·36 „	6·38	In very good ploughing condition	Mean of two tests with a four-furrow "All-Conqueror" Ramsome's disc-plough. This is a very heavy plough of weight equal to 1,635 lb. Sixteen oxen were used.
9	Top of Field No. 18	8·43 „	5·86	The trial was made entirely in the lighter soil (red loam) of this field, which was in good ploughing condition. Ground had not been ploughed for six months before date of trial	Mean of two tests with a four-furrow "All-Conqueror" Ransome's disc-plough. Sixteen oxen were used.
10	Field No. 18	With disc-coulters 15·24 lb.; without disc coulters 13·76 lb.	7·66 8·17	The soil is a loam reputed to be one of the lightest on the farm, but had not been ploughed for six years before date of trial. It had been pastured each winter and hence well trodden and compacted. So far as moisture was concerned, the soil was in good ploughing condition. Field was laid down to lucerne six years ago and was full of lucerne and grass roots, but could not be described as "sod," the surface of the land being bare of growing vegetation	Each of the figures given is the mean of four tests with a two-furrow "Prince" mouldboard plough. This trial shows that the use of coulters was a disadvantage. Fourteen oxen were used, but were very hard-worked.
11	Camp No. 1	Test No. 1, 6·93 lb. Test No. 2, 9·75 lb.	7·60 7·75	In test No. 2 the soil was harder and drier than in test No. 1. The soil was becoming too dry and was heavy to plough. The mealie crop had been cut the day before the trial. Test No. 1 was where the mealies had stood. Test No. 2 was just outside of the edge of the mealies	Two tests with a three-furrow "Prince" mouldboard plough.



Scale :
11 mm. = 50 Cape Roods.

In trial No. 1, which, so far as the work in the lighter soil is concerned, is comparable with trial No. 9, the draft per square inch of furrow-slice with a mouldboard plough was 7.2 lb., the ground being noted as having been in fair ploughing condition, but on the dry side. In trial No. 9, the draft per square inch of furrow-slice with a disc-plough was 8.43 lb., the ground being noted as having been in good ploughing condition The disc-plough ran shallower than did the mouldboard plough, hence there is no question of the heavier comparative draft of the former being due to deeper ploughing. The comparison is unfavourable to the disc-plough.

Trial No. 3, also, shows that the disc had a much higher draft than had the mouldboard plough. The disc-plough, however, in this case, did extra work in pulverizing the soil, and left it fit to be dealt with by a disc-harrow, which was not the case with the mouldboard plough. For practical reasons, therefore, the disc-plough, despite its heavier draft, would be preferred under these conditions, viz., the ground too dry to be in good ploughing condition and liable to break up into large lumps on being ploughed.

In trial No. 2, again, when the mouldboard plough was run at approximately the same depth as the disc-plough, which could not be got to run deeper, its draft was considerably lighter than that of the disc-plough (6.13 per square inch in furrow-slice against 7.34 lb.).

These three comparisons are all the same in pointing to the disc plough as a heavy-draft implement compared with the mouldboard plough, but, before this can be stated definitely, further comparative tests of disc *versus* mouldboard ploughs are required.

Trials Nos. 5 and 6 are also comparable. Trial No. 5 was run twenty-four days earlier than trial No. 6. They illustrate the effect on the draft of the soil being rather wet and clinging to the mouldboards; the draft increased from 4.52 to 6.45 lb. per square inch of furrow-slice.

Trial No. 4, in which the chemistry fertilizer plots were ploughed across, was for the purpose of seeing what effect on the draft was produced by different manurial treatment of the plots. These plots have been fertilized for six years, each plot being alternately manured for two successive years, left unmanured for the following two years, and so on. The manures used were kraal manure, superphosphate, bonemeal, ammonium sulphate, lime, green manure, and Saldanha Bay phosphate.

The results of these tests were such that no distinctive differences in the draft could be ascribed to the manurial treatment of the plots. This result agrees with that found at Rothamsted by Mr. W. B. Haines and Dr. B. A. Keen, who say that "the conclusions as to the effect of manurial treatment are only of a general nature at the present stage of the work. Such differences are certainly small in comparison with the natural variations in the soil." *

The draft in trial No. 10, without coulters, was 13.76 lb. per square inch of furrow-slice; with coulters it was 15.24 lb. per square inch of furrow-slice. This is the heaviest draft recorded in the whole series of trials. The soil had not been ploughed for six years before the date of the trials. It had been laid down to lucerne and was pastured each winter so that it was well trodden down and

* "Studies in Soil Cultivation. III: Measurements on the Rothamsted Classical Plots by means of Dynamometer and Plough." *Journal of Agricultural Science*, July, 1925.

compacted. When tested it was in good ploughing condition so far as moisture content was concerned. As stated in the table, there was no surface sod.

The next heaviest draft recorded was in the heavier soil ploughed in trial No. 1, viz., 11.5 lb. per square inch of furrow-slice, when the soil was in fair ploughing condition. This soil is much heavier than that tested in trial No. 10, but had been ploughed six months before the date of its trial. The comparison shows, in a striking manner, the effect of compaction of the soil in increasing the draft.

Trial No. 10 was run for the purpose of determining the advantage, or otherwise, of using coulters. The ground in which the trial was run was thought to be very favourable to the use of those attachments, as it was full of old lucerne roots and grass roots.

Four tests were run with the plough without coulters, and four with coulters. Disc-coulters of the castor type were used. It was found that the use of coulters increased the draft of the plough by 10.75 per cent.

There is a sphere of work open in dividing a field into squares and running dynamometer tests across the middle of each one, in order to determine the draft for each square. In this way details of the physical condition of the soil of the field can be obtained. The crop-yields from the individual squares can then be compared with the physical characteristics of the soil, as indicated by the draft deduced from the dynamometer record.

It is suggested that along these lines the effect of the physical differences of the soil on the crop can be allowed for in future plot experiments.

The writer has to thank Mr. E. Silcock, of the engineering section, for valuable aid in the mechanical running of the Watson draw-bar dynamometer, which was the type used.

Outbreaks of Animal Diseases: December, 1925.

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Total for Dec., 1925.	Total for Calendar Year 1925.
East Coast Fever	—	4	—	—	—	4	69
Mange	2	4	10	3	2	21	527
Anthrax	24	10	4	15	34	87	970
Dourine	—	—	1	—	—	1	21
Glanders	—	—	2	—	—	2	48
Tuberculosis	—	—	3	—	—	3	11
Epizootic Lymphangitis	—	—	—	—	—	—	1

COST OF WHEAT PRODUCTION.

Result of an Independent Investigation.

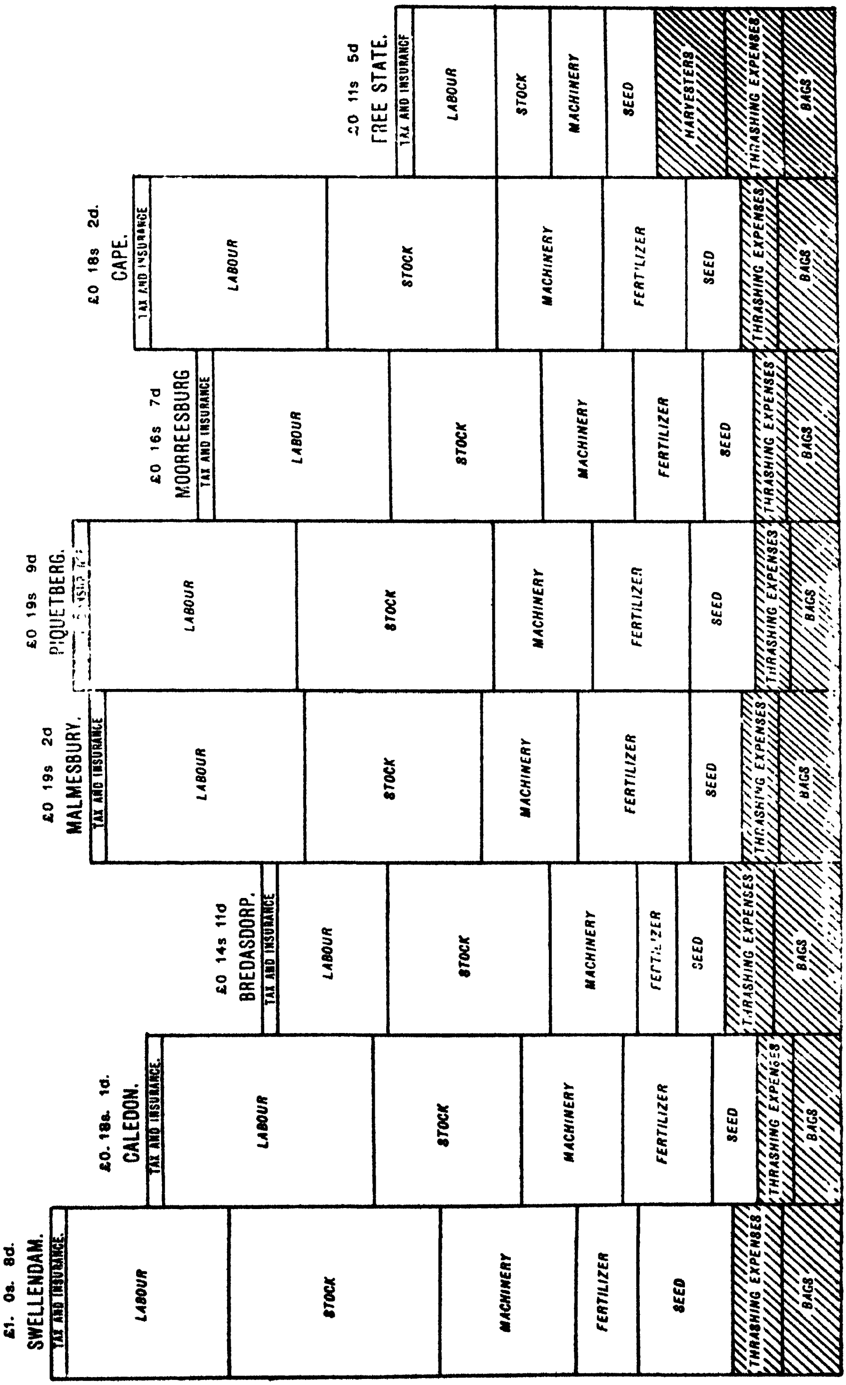
WHEAT growing was one of the branches of farming introduced by the first settlers on the shores of Table Bay, and since those early days has maintained an important position in the agriculture of the country. It is still supreme in the winter rainfall area, and still supports a large body of prosperous farmers. Yet the toll of years of unrelieved wheat growing is surely being exacted, and the crop is not the lucrative one of olden times. The economics of wheat production is a burning question to-day, and it is a question, moreover, upon which scanty information is available, notwithstanding the age of the industry. True, there have been investigations into the matter, and data have been accumulated from time to time, but an authoritative pronouncement has still to be made. In the meantime our rate of production remains almost the lowest in the world, and, naturally, the cost of production is relatively high.

It is a subject of prime importance to agricultural South Africa and one that will receive the attention of the newly created Division of Economics and Markets of the Department. This Division has a limited number of available officers and a great list of economic problems to tackle, but one of its first steps was to secure the services of a temporary officer, Dr. Carel Potgieter, to make a rapid survey of those wheat growing districts of the Union where the crop is known to be profitably grown. The object was to secure certain data that would assist farmers in deciding upon the part that cereals should occupy in their scheme of farming, for a great many are ignorant of the actual profit or loss derived from wheat growing.

To deal exhaustively with the economics of wheat production would require the results of many years of investigation; nevertheless some interesting figures were obtained by Dr. Potgieter, based particularly on the returns of two seasons, 1922 and 1923. Many farms were visited by him and valuable information gleaned from the farmers. This was carefully sifted and weighed, and showed that the average cost of production, in the Cape, of a bag (200 lb.) of wheat was £1. 0s. 11d. This was based on the returns of three seasons, but for the two seasons mentioned above, Dr. Potgieter arrives at the figures shown in the accompanying graph.

Dr. Potgieter points out, in a report on his investigation made to the Chief of the Division of Economics and Markets, that although the graph shows the cost of production of wheat in the Orange Free State to be about one-third less than the Cape, there had been no harvest to speak of in the Orange Free State for the three previous years, and if certain costs over that period (labour, machinery, seed, etc.) were taken into account, the figure would rise from 11s. 5d. to 24s. per bag. Failure of crop was due to locusts, hail, drought,

COMPARATIVE COSTS OF PRODUCTION.



and blight, evils from which the Cape is comparatively free. For this reason the Cape farmer can afford to incur greater expense in the production of his crops, for of their ultimate success he is more certain.

SOUTH AFRICAN PRICE OF WHEAT.

South Africa has two prices for wheat: the lower of these is that at which the farmer sells his produce and the other the wholesale price. At times there is a conspicuous difference between these prices. In 1921, for example, the average wholesale price in South Africa stood at 33s. 2d., whereas the farmer's remuneration for a bag of wheat averaged not more than 28s. In October, 1924, the position was much the same. The wholesale price was 32s. 3d. Speculators travelled through certain districts and bought up the prospective crops on a number of farms at 25s. per bag. In January, 1925, the wholesale price stood at 31s. 3d., a shilling less, therefore, than in the previous October, yet wheat still realized from 29s. to 30s. per bag.

FUTURE PRODUCTION.

Dr. Potgieter is of the opinion that in South Africa production of wheat on a large scale cannot be expected. Malmesbury and adjoining areas have been cultivated to the very limit. In Caledon, probably an addition of 10 per cent. can still be made in the number of wheatfields: for Bredasdorp the figure is a little higher. But to supply the country with wheat, even at the present rate of consumption, a production twice as large as the present is needed, and this is out of the question. Naturally there are methods of an improved type which can be introduced for cultivating the soil. In wheat producing districts, no green manuring is practised and it is questionable whether other fertilizers are being applied in sufficiency. To have a few experimental stations in the wheat producing areas will perhaps convince the farmers of the advantages of good fertilizing. But even with more intensive and scientific cultivation, it is by no means conceivable that the farmers will be able to supply all the country's wheat. An extension towards interior parts is subject to too many hazards, such as drought, locusts, blight, and hailstorms, to achieve any measure of permanent success. And even should production be extended, increasing consumption would far exceed it.

The migration of natives to towns, the increase of their wealth and living standard will mean additional consumption. Also amongst Europeans the consumption of bread grows apace. A contributory factor is the improved system of grinding wheat, which makes bread more attractive. Compared with France and Belgium, South Africa has a lower consumption of wheat per head of population. In France and Belgium the annual consumption per head is 480 lb. In 1923 South Africa produced 362 million lb. and imported 285 million lb., in all 647 million lb. Taking both white and coloured population as wheat consumers, this averages about 300 lb. per head, and with the natives included, the figure is 100 lb. per head. It seems, therefore, that South Africa will continue to import wheat; and with good organization the price of wheat should be equal to the world price, plus cost of transportation and import duty.

INCREASE IN THE VALUE OF WHEAT LANDS.

The great demand for wheat in South Africa has led to a rapid increase in the value of wheat lands. For instance, Bredasdorp, in the last twenty years has opened up as a great wheat producing district: during that time the value of land increased fivefold. As a result of improved machinery and methods of production the products of the soil and consequently their prices have risen to a high level. In the same way as our price of wheat is governed by that of foreign countries, so also is the increase in the value of our wheat lands determined. In Canada the price of wheat lands is approximately £10 per morgen. Out of a possible 170 million acres in the Provinces of Manitoba, Saskatchewan, and Alberta, less than 40 million are under cultivation, only half being under wheat. The value of its produce determines the value of the soil. Seeing that wheat soils are abundant in Canada (so abundant indeed that it is claimed that Canada alone can furnish the world with wheat), and that there is no reason why there should be a world scarcity of wheat and a constant increase in its price, the price of wheat lands will nowhere in the world, under free competitive circumstances, permanently stand at a very much higher level than it is in Canada, where the available land—at least for our generation—is inexhaustible. If Russia were again to figure as a wheat producing country, there would be a surplus production of wheat. The fact that wheat is imported into South Africa is contributive to the high prices wheat lands realize here. It has been stated, however, that wheat land has already gained its maximum value in South Africa. Be that as it may, it is apparent that more and more the farmer must consider his own exertion as being the only means from which to derive his profits, and rely less on the possible increase in the value of his land as a means of supplementing his profits. For this reason the time has come when the farmer should be well acquainted with the economics of his activity and see the necessity of enlisting the aid of science in the production of his crops.

ECONOMY OF WHEAT FARMERS.

Almost without exception, an economical manner of life is practised throughout the whole of the Caledon and Bredasdorp districts. During the lifetime of the present owners land has not been very expensive. Money was scarce. The hard school which bred them taught them to lead a simple life which they in turn have inculcated in their children. There are farmers worth £20,000, £50,000, £100,000, and £250,000, and yet their manner of life has remained extremely simple. As a result of their economy their properties generally are unencumbered. There is no request for mortgages, and the rate of interest is 5 per cent. as compared with 6 per cent. in Malmesbury and the Orange Free State, and from 7 to 8 per cent. in the Transvaal.

CONCLUSIONS.

While the data collected by Dr. Potgieter will help to throw light on the subject, much has admittedly yet to be done before a true conclusion can be arrived at as to the part wheat growing

should have in the farming economy of the country. But certain grave disabilities are apparent, and foremost is the uncertainty under which many farmers carry on their enterprise; to a large extent many are unaware of the results of their wheat growing and of the prevailing market value of their grain.

It is essential that every farmer should compare his cost of production with the market price as a means of determining his own profit. If the profit, i.e. the difference between the cost of production and the market prices of wheat, is relatively less than in the case of oats, milk, or wool, efficient farm management requires that, if possible, more time should be devoted to oats, milk, or wool and less to wheat. Every farmer is anxious to carry this into effect. Every one wishes to obtain the greatest profit. The only difficulty lies in the fact that they are not all acquainted with the manner in which profits are calculated in each specific case. Investigations—of which the present is a type—aim at being instrumental in aiding the farmer to make an analysis of his occupation, and by so doing to make it possible for him to adapt his activities to the demands and prices of the market.

Commenting on the value of co-operation, Dr. Potgieter points out its helpfulness, among other things, in the purchase of machinery and fertilizers at a cheap rate; to retain their custom merchants are compelled to reduce their prices accordingly. Remove this co-operative factor and prices would rise and so reduce the profit of the farmer. Co-operative trading is the means of reducing the disparity in the wholesale price and the price the farmer receives; moreover, in the minds of many farmers there does not yet appear to exist in this country a true relation between the world price and the South African price for wheat, after allowing for freight, duty, etc.

INQUIRIES AND REPLIES.

SELECTED LETTERS FROM FARMERS.

[Hereunder are a number of recent letters replied to by the various Divisions and Schools of Agriculture concerned. They are selected for publication as being of interest to farmers generally in the localities affected. In each case the area only from which the inquiry emanates is given; as the replies must necessarily be curtailed, they will indicate, when required, literature from which further information may be had. All departmental bulletins quoted are obtainable on application to the Editor.]

Suitable Trees for Windbreaks.

Arundel, Cape Province.—I want to plant trees for windbreaks above my lands, also above the farm on the north-west side to break the terrible wind from that side. I am told that I should plant *Cupressus arizonica*. What varieties of trees would you recommend for this purpose?

Grootfontein School of Agriculture replies: Where a strong windbreak is required you could use either *Eucalyptus rostrata* or *Eucalyptus sideroxylon*.

Along the lands where a lighter windbreak is required, or where the crops may be troubled by the roots of the eucalypts, *Pinus halepensis* or *Cupressus arizonica* could be used. The latter variety makes a light windbreak also suitable for planting round the homestead.

Cultivation of Bananas.

Park Rynie, Natal.—Can you supply me with any literature on banana cultivation in South Africa?

The Chief, Division of Horticulture, replies: This Department has not published any bulletin on the subject. Banana growing is mostly in the hands of coloured people and Indians. There is very little art in it. The process is simple. Suckers are put in about 12 feet to 15 feet apart and cultivated as for other tree crops. As the fruit comes along new suckers spring up; the old plant is cut off and the next biggest sucker is allowed to take its place, and so on. Handlers of the banana in Durban could give you most of the information you require, and if you intend to grow the fruit on a commercial scale you should get the work by W. Fawcett entitled "The Banana." It is published by Duckworth & Co., London, and should be obtainable from booksellers in South Africa. A copy is kept in this Department's Library at Pretoria.

Disease amongst Goslings.

Bethal.—There is a disease amongst my goslings. The joints of both feet swell and the birds become lame and eventually die.

The School of Agriculture, Potchefstroom, replies: It seems that the goslings must be suffering from osteo-arthritis. This is a disease

to which only goslings and ducklings are subject. Usually 90 per cent. are attacked. Fowls, doves, grown-up ducks, and geese are not subject to this disease.

The disease takes two forms, either an acute form with rapidly fatal results, or as a chronic type from which the gosling suffers for a long time before it recovers or dies. In the first case the goslings become listless and eat less; then they become lame in one or both legs. The joints swell, become warm and painful. The wings may also be attacked, which then usually hang down. There may also be diarrhœa. In the second case the thick joints are usually the first symptoms to be noticed. The birds do not appear so listless and they try to walk about and seek food. There may be a little diarrhœa at first, but later the birds become emaciated. The disease may go on like this for some fourteen days or more, and then the birds will either die or recover. Sometimes the swellings continue for a few weeks, and during that time the bird does not grow any larger.

The disease is infectious, the infection arising from the pus which comes from the swellings of the joints, and can only be checked by removing all the diseased or dead birds from the healthy ones and burning the carcasses of the dead ones. The coops must be cleaned out and kept clean, and the droppings must be removed.

Treatment of the swollen joints may also be tried by an application of tincture of iodine or some other disinfectant.

In case the disease looks dangerous and is spreading rapidly a diseased bird may be sent to the Government Laboratory at Onderstepoort, Pretoria, for examination, so that steps may be taken to check it.

Engine Power for Sawbench.

Middelburg, Cape.—I have recently bought a second-hand sawbench with a few saws, the diameter of the largest one being about twenty-four inches. I wish to cut up a lot of timber, some of which is up to six inches thick. I have a petrol engine of four horse-power. Will this engine be able to drive the saw?

Grootfontein School of Agriculture replies: It would not be advisable to drive a sawbench with a 4-horsepower petrol engine because it is not strong enough, and if it does cut wood up to six inches thick the engine will be overloaded. A more powerful engine should be used; or a smaller size saw should be fitted, and then the timber should be fed very slowly. A 4-horsepower engine might then be able to do the work.

Water Supply for the House.

Aberdeen, C.P.—I have a windmill about one hundred yards away from my house, pumping into a dam, from which a pipe runs to another dam near the house. The fall in the ground from the windmill to the house is about ten feet. I want to lay on piping to the house and to the flower garden, but find that by just connecting to the pipe that comes from the windmill dam, I do not get sufficient pressure for a water supply. What would you recommend me to do?

Grootfontein School of Agriculture replies: You should get, say, a 600-gallon tank, and put this on a tower, say, ten feet high, or

higher if the height of the windmill will allow it. Pump the water from the borehole into the tank, and connect the pipe line to the bottom of the tank. At the house put another tank on top of a tower at such a height that the top of the "house-tank" is about five or six feet below the top of the windmill-tank. Connect the house and garden pipe line to the bottom of the house-tank and connect an overflow pipe near the top of the house-tank, to lead to the dam near the house. By fixing it up this way you will nearly always have a full tank at the house, and sufficient pressure for a water supply for domestic and garden purposes.

Fertilizers.

Kestell.—If my crops should fail in consequence of drought, insects, or excessive rain on land fertilized this year, will the ingredients of the fertilizer remain in the soil and be available for next season's crops?

School of Agriculture, Glen, replies: Yes, the ingredients of fertilizers, especially phosphates, remain available in the soil for a long time. What is not used by plants this year will be available next year. A certain percentage—particularly nitrogenous and potassic manures—will be lost through leaching in case of excessive rains.

Analysis of Fertilizers.

Aberfeldy, O.F.S.—The accompanying sample of fertilizer is from a large consignment received which is very lumpy and appears unsatisfactory. The fertilizer ordered is the "bone, super, and potash," marked on the enclosed price list. Is the analysis on the price list a guarantee of the quality of the fertilizer, and did the latter contain too much moisture when sent? Will you always be willing to do such analyses for farmers?

School of Agriculture, Glen, replies: For information regarding analysis see regulations Nos. 22 and 27 of the Fertilizer Act. An analysis of the sample you sent would be of no practical value, since the sampling, in the case where litigation may ensue, is the most important factor in the whole procedure. Assuming your sample is analysed here and that something wrong is found, the firm concerned could, since the sample was not properly taken, repudiate the figures obtained. In short, the analysis would be a waste of our time and your money (the fee for analysis is £4. 4s.). The question of lumpiness is not a matter for chemical analysis. This matter you will have to take up direct with the firm concerned, since the Act does not lay any restrictions on the percentage of moisture in a fertilizer. If you feel that the fertilizer is not up to the guaranteed analysis furnished by the firm (which, by the way, is supposed to be a guarantee of the chemical composition), you better act as follows.—Order a further small quantity, say half a ton, and immediately on arrival of this at your station, notify the sellers of your intention to have it analysed according to regulations.

It may be pointed out that the Schools are out to help the farmer in every possible way, but at the same time must employ their time to the fullest advantage. This analysis would be uneconomical, both of their time, the taxpayers' money, and the amount you would have to pay in fees. Any further advice required will be willingly given.

Home-made Cheese.

Dassie Deur, Cape.—I used to feed sour-milk to the chickens, but having given up poultry, I would be glad to know if there is any other way to make use of it?

Grootfontein School of Agriculture replies: Make it into a soft cheese as follows: Keep the milk perfectly clean and when sour turn it into a piece of linen or huckaback cloth. Tie it up by bringing the corners of the cloth together, or with a piece of string, and hang in a cool place to drain. Open the cloth occasionally and scrape down the sides, preferably with a silver or bone knife. The more times the cloth is scraped the quicker the cheese will be ready. When in a pasty condition, turn into a bowl and apply salt and pepper to taste. Mix well together and mould up into any convenient shape. The cheese is now ready for consumption.

Different Methods of Irrigation.

Bethulie, Orange Free State.—What different methods can be used to distribute water on irrigable lands?

School of Agriculture, Glen, replies: There are four ways of distribution, viz.:—

(1) *Flooding.*—A furrow is run along the side of the land to be irrigated. The water is turned off from this furrow at successive points at short distances apart and allowed to spread over the part to be irrigated.

(2) *Furrows.*—Water, lead by furrows about 6 inches wide between the rows of the crop, soaks into the soil and spreads outwards towards the root systems of the plants. The advantage of this method is that less surface soil is wetted, which means less loss by evaporation before cultivation can be affected.

(3) *Basins.*—Usually practised in orchards. Small basins are made around each tree. To allow the water, however, to lie against the tree-trunk is a mistake, and care should be taken to avoid this by making the basin in the form of a ring round the tree. With the latter arrangement the water reaches more of the smaller roots of the tree. Difficulty occurs with this system when cultivating with a horse-drawn implement.

(4) *Checks.*—The enclosure of beds ("akkers") by means of banks and irrigating each bed separately. This method ensures a very uniform distribution, and is one of the best to be adopted.

Oxen, and System of Ploughing.

Rustenburg.—(1) Providing that oxen run at night in a camp with good grazing and also a salt and bonemeal lick, how many hours per day can they work in order that they may be maintained in good condition?

(2) Is it a good practice to feed oxen in kraal, after watering, during the midday outspan in order to save time and herding and provide a certain amount of manure? If feasible, what variety and quantity of feed per head would be required?

(3) Have any experiments been carried out to determine the functioning of the long yoke with the 3-furrow disc-plough?

(4) If a soil is light and easily worked, how many acres per day should be (*a*) ploughed with a single-furrow plough (14-inch bottom) or (*b*) a 3-furrow disc-plough; (*c*) harrowed with a 9-foot harrow; (*d*) cultivated, using two cultivators drawn by two oxen each, and (*e*) planted with a double-row planter drawn by four oxen?

(5) What is the best mechanical means to cut mealies for silage or stover?

School of Agriculture, Potchefstroom, replies:—

(1) Oxen doing hard work will lose condition if they must subsist on veld grazing only.

(2) You can certainly kraal the oxen during the midday outspan. The best feed would be a mixture of teff and lucerne-hay from 7 to 10 lb. per ox per feed. There are no hard and fast rules in feeding and management of oxen—it is an art.

A grain ration would be too expensive, but lucerne-hay and teff-hay will supplement ordinary grazing and keep the oxen in good working condition.

(3) Experiments carried out here with yokes of proper length for a 3-furrow *mouldboard* plough with 12-inch bottoms showed a diminution in the *draft* of 10 per cent., and also greatly improved ploughing.

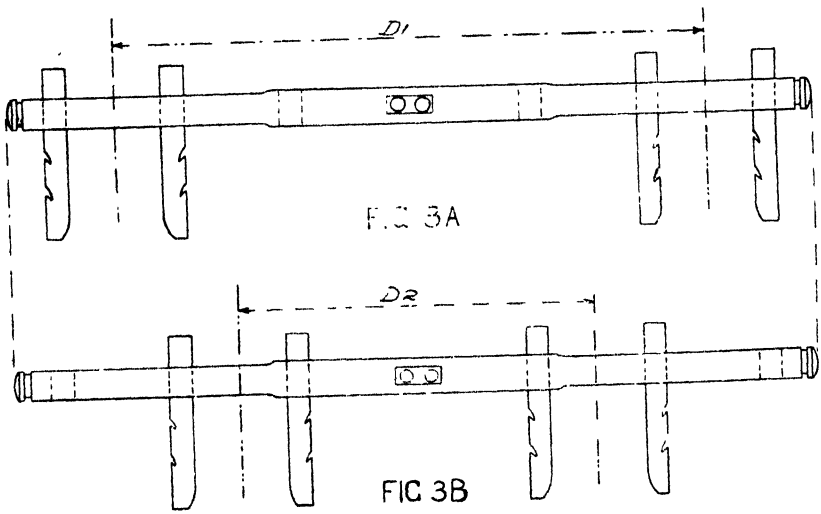


Fig. 3A.—Set for a three-furrow plough.
Fig. 3B.—Set for a single-furrow plough and wagon traction.

DR. CLEGHORNE'S IMPROVED OX-YOKES.

(4) The following figures have been got from our operations here with oxen:—

(*a*) A single-furrow plough does about 1 acre per day, or perhaps a little more in a long summer's day.

(*b*) A 3-furrow disc-plough does about 2 to 2½ acres per day, or about the same as a 2-furrow mouldboard plough.

(*c*) With one span of oxen and a 2-furrow mouldboard, or a 3-furrow disc-plough, it may be taken that 1 morgen per day can be ploughed and harrowed. A 3-furrow disk plough, as a rule, does no more than a 2-furrow mouldboard plough. Probably you would get best results with a 3-furrow mouldboard plough with 12-inch bottoms and the adjustable yokes, as shown in Fig. 3A.

The following (*d*) and (*e*) are from observations on this farm:—

(*d*) A 1-row (two half-rows) cultivator did 35 yards by 400 yards, i.e. nearly 3 acres, in six hours, or nearly half an acre per hour.

(*e*) A 2-row planter planted 75 yards by 380 yards (i.e. nearly 6 acres) in six hours, or nearly 1 acre per hour.

(5) Do not cut mealies with a mower. A machine known as a mealie-binder is used, but it is expensive and would be used more for large scale operations. An implement that is often home-made is the Sled Mealie Cutter. These machines are arranged with fixed knives (often old chaff-cutter knives) set at an angle (so as to give a "draw-cut") on the edge of a sled, and at such a height that the standing stalks will be cut off as they are grasped in the arms of the operator standing or sitting on the platform, the sled meanwhile being dragged between the rows

A still simpler device, sometimes used in South Africa, consists of a forked branch of a tree in the form of a V. This has old mower knives fixed, points outwards, on each leg of the V and well sharpened. On the V being dragged between two rows, point foremost, the knives cut the stalks of each row.

Potato Tuber Moth.

Weenen, Natal.—I have discovered tuber moth in my seed potatoes and wish to know how to treat these before planting, so as to kill the eggs, etc.

School of Agriculture, Cedara, replies: Fumigation with carbon disulphide will kill all stages but eggs. Therefore one treatment is not sufficient and fumigation must be repeated at least once with an interval of about a week, eggs having been hatched in the meantime. Two treatments properly carried out are usually enough.

Put potatoes in an air-tight room or tank, stopping up cracks around windows, etc. by pasting over with brown paper. Use 3 lb. of the liquid for each 1,000 cubic feet of space. Pour liquid into shallow vessels and place them on top of potatoes.

Resulting gas is heavier than air, going downward. Leave exposed to fumes for about forty-eight hours. Carbon bisulphide is highly inflamable, hence great care must be taken to prevent smoking or fire lighting from taking place near potatoes under fumigation or near stored liquid. Ventilate by opening the bottom of tank. Be sure to destroy any infested potatoes not fumigated by using it as feed.

Indications of Egg-production in Young Hens.

Ermelo.—What are the indications that a young hen has begun to lay?

The School of Agriculture, Potchefstroom, replies: The first indication that a young hen is about to begin laying is the development of her comb and wattles. These parts become larger, bright red, and soft. This indicates that the ovaries are developing. That laying has commenced can also be noticed by the enlarged and moistened condition of the vent. The space between the back point of the breast bone and the pelvic bones grows bigger and soft.

In the case of Leghorns, Wyandottes, Rhode Island Reds, and other breeds which have a yellow skin, it is easy to say which hens have commenced laying. Those that turn pale first will also be the first to begin laying; the pigment is drawn off for colouring the yolk of the egg and it disappears in the following order: First from the vent, then the eyelids, lobes, beak, and lastly that of the legs. After laying has discontinued the pigment returns in the same order. This pigment, or "Xanthophyll," appears in the yolk of the egg, and that is why it returns to her body as soon as the hen stops laying.

Blow-fly Traps.

P.O. Malanspost.—In regard to the article in the *Agricultural Journal* dealing with blow-flies, I should like to know:—(1) How far can a blow-fly scent a trap? This will enable me to know how many traps to place on my farm. (2) Supposing a carcass is left on the veld and has decayed, but the pupae have not yet hatched out, would it be possible to destroy them by heaping dung on the spot and burning it? In other words will the ground become hot enough to kill those that have crept into the ground? A good few such sheep carcasses lie about on my veld.

The Grootfontein School of Agriculture replies: (1) Much depends on the wind and the strength of the smell given off by the bait, and this again depends on the quantity of meat placed in the trap. It is considered that a blow-fly will easily fly half a mile to a trap if there is not too much other bait in the vicinity.

The trap, as described in the November issue of this *Journal*, is merely for the purpose of getting carcasses out of the way and not to catch full-grown flies. Two such traps should be enough on a farm.

To catch the flies themselves traps made from paraffin tins and wire gauze are used. Blow-flies are found chiefly near houses, sheep camps, rivers, and dams. At Grootfontein there are fourteen such traps, and that is about as many as a farmer can manage.

(2) The idea of making a fire on the spot where the carcass lay is quite a good one provided it is big enough to thoroughly heat the ground. It will, however, only kill a small percentage of the pupae as the majority of maggots, on leaving the carcass, go a few yards before they bore into the ground to pupate. If at all possible the carcasses should be gathered and placed in the traps before the maggots are full-grown.

If there are so many dead animals lying about on your farm it is not surprising that you are troubled with blow-flies.

Maize Stalkborer.

Dundee, Natal.—When a mealie plant has been attacked by top grub and the plant is broken off at the point of attack, so that the portion containing the grubs is thrown to the ground, what happens to the grubs? Will they leave that plant and attack another, or continue the cycle as if they had not been interfered with, or will they die?

School of Agriculture, Cedara, replies: A complete answer as to the behaviour of maize stalkborers in cut-off tops cannot be given, since precise scientific data is lacking on this point. It is certain, however, that you cannot depend upon this cutting off to kill all of the grubs in all sorts of weather. The number dying would depend upon two factors: First, age of grubs; second, weather. Newly hatched out grubs, in the stage when they feed on top leaves as minute caterpillars before boring into stalk, would not be killed by cutting off tops under any conditions, since worms in this stage are naturally spread about by wind on threads of silk and hence could readily "balloon" away from wilted tops on the ground. Fairly large grubs would not be killed, since it is very usual for them to drop on to ground from stalk of plant and re-enter it or another plant at surface. Even if soil were very hot it is fairly certain that large grubs would get into new stalks from the wilted top without much danger. The fate of very small grubs which have passed the travelling stage (in second and third stages) would be open to question. It seems likely that these delicate grubs would die quickly on hot soil, or even within a hot, dried-up plant top. They would not die in cool or rainy weather. In hot weather they might leave top at night. At the time when farmers apply top dressing most of the grubs would be in the stage likely to die on hot soil, but even so the cutting off of tops as a substitute for top dressing cannot be advised at present, since most or many of the grubs would probably get into other plants.

STAFF: APPOINTMENTS, CHANGES, ETC.

3/3/25 *St. C. O. Sinclair*, M.A., D.Sc., F.I.C., appointed Chief of the Division of Chemistry, Pretoria (with retrospective effect).

23/11/25 *G. J. de Wet*, M.R.C.V.S., Government Veterinary Officer, Durban, transferred to Pietersburg.

25/11/25 *C. J. Hopkins*, B.Sc., Mycologist, Division of Botany, Pretoria, transferred to Capetown.

28/11/25 *P. L. le Roux*, M.R.C.V.S., B.V.Sc., Veterinary Research Officer, Pietermaritzburg, transferred to Nooitgedacht Experimental Station, District Ermelo.

1/12/25 *J. I. Edgar*. Government Veterinary Officer, Pietersburg, Transvaal, transferred to Port Elizabeth.

18/12/25 *J. I. Raats*, M.A., appointed First Grade Markets Officer, Division of Economics and Markets, Pretoria.

18/12/25 *D. J. J. Mostert*, B.A., appointed Second Grade Economist, Division of Economics and Markets, Johannesburg.

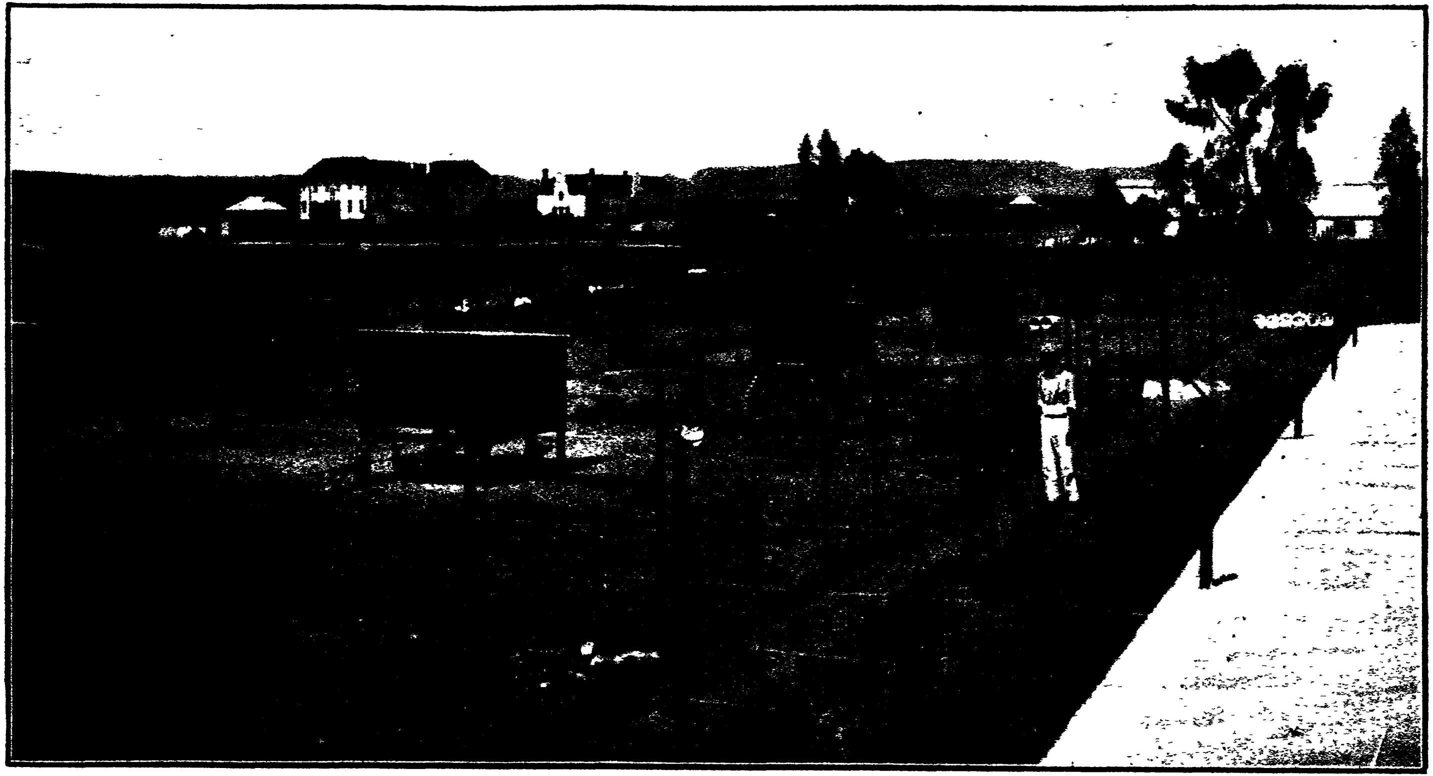
NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Gazette*:—

(Abbreviations: "Proc."-Proclamation. "G.N."-Government Notice.)

Gazette. No.	*Date.*	*Items.*
1517	11/12/25	*Crown Lands for Disposal.*—The following pieces of Crown lands will be offered for sale by public auction on the dates and at the places specified:— (*a*) Certain lots in the village of Kidd's Beach, East London Division, on the 20th February, 1926, at Kingwilliamstown. Diagrams and conditions of sale may be seen at the Department of Lands, Pretoria, and at the Office of the Magistrate of Kingwilliamstown. (G.N. No. 2183.) (*b*) The land called Welgedacht Annexe, being portion of the Varkenshoek Outspan, in the Division of Cradock, in extent approximately 80 morgen, on the 24th February, 1926, in front of the Court-house, Cradock. The general conditions of sale may be seen at the Department of Lands, Pretoria, and at the Office of the Magistrate, Cradock. (G.N. No. 2184.)
1517	11/12/25	*Dipping.*—The compulsory dipping of sheep and goats has been ordered as follows:— (*a*) In the District of Cradock, Cape, during the period 4th January to 15th February, 1926. (G.N. No. 2167.) (*b*) On certain farms in the western portion of the Wodehouse District, Cape, during the period 1st January to 31st March, 1926. (G.N. No. 2186.) (*c*) In the Districts of Glen Grey, Elliot, Maclear, Barkly East, and Wodehouse (exclusive of that portion referred to in G.N. No. 2186 of 1925), during certain specified periods. (G.N. No. 2187.)
1522	24/12/25	(*d*) In the restricted area of Mafeking District and the non-protected portion of Vryburg District, Cape, as defined by Government Notices Nos. 1717 of 1925 and 1603 of 1925, respectively, during the period 1st February to 31st March, 1926. (G.N. No. 2303.) (*e*) In the District of Mafeking, Cape, exclusive of the restricted portion of this district as defined by Government Notice No. 1717 of 1925, during the period 1st February to 31st March, 1926. (G.N. No. 2304.) (*f*) In the Districts of Bethal, Carolina, Middelburg, and Lydenburg, Transvaal, during the period 1st February to 30th April, 1926. (G.N. No. 2306.) (*g*) In the Districts of Richmond, Hanover, and Middelburg, Cape, between the 15th January and 28th February, 1926. (G.N. No. 2308.)
1524	8/1/26	(*h*) In the Districts of Beaufort West, Albany, Uitenhage, Humansdorp, and Herschel (Cape), Fauresmith, Boshot, and Rouxville (Orange Free State), between certain specified dates. (G.N. No. 42.) The compulsory dipping and hand-dressing of cattle has been ordered as follows:—
1517	11/12/25	Every seven days in the seven-day dipping-fluid on (*a*) the farms Helena No. 1865, Lonsdale Nos. 948, 949, and 950, and Graaff-Reinet No. 951, Pietersburg District

1522 1524	24/12/25 8/1/26	(G.N. No. 2189); (*b*) certain farms in the Barberton District, Transvaal (G.N. No. 2310); (*c*) all farms within the Magisterial District of Piet Retief, Transvaal, during the months of November to April, and every fourteen days in the fourteen-day dip during the months of May to October each year (G.N. No. 41).
1520 1523	18/12/25 31/12/25	Every five days in the five-day dipping-fluid on (*a*) Lots Nos. 234, 235, 236, and 253, Lower Umfolozi District, Zululand (G.N. No. 2243); (*b*) the farm Doornhoek No. 204, Vryheid District, Natal (G.N. No. 2352).
1523	31/12/25	*Approved Dips.*—Certain dips have been sanctioned as "approved dips" for the dipping of infected sheep under official supervision. (G.N. No. 2351.)
1522	24/12/25	*Export of Dried Fruit.*—The regulations for the export of dried fruit under the Agricultural Export Act, 1917 (Act No. 35 of 1917), have been amended. (G.N. No. 2268.)
1524	8/1/26	*Fencing.*—Contributions towards the cost of dividing fences have been declared obligatory in Ward No. 4, Gordonia District, Cape. (G.N. No. 2.)
1524	8/1/26	*Introduction of Cattle and Meat from Neighbouring States and Territories.*—The regulations regarding the introduction of slaughter cattle into the Union from Southern Rhodesia, Bechuanaland Protectorate, Basutoland, and Swaziland have been amended, and permits will only be issued in respect of cattle that comply with certain conditions. (G.N. No. 40.)



POULTRY SECTION, SCHOOL OF AGRICULTURE, GLEN.

JOURNAL OF THE DEPARTMENT OF AGRICULTURE.

VOL. XII. MARCH, 1926.

Published monthly in English and Afrikaans by the Department of Agriculture Union of South Africa.

SUBSCRIPTION: Within the Union and South-West Africa, 5s. (otherwise 6s.) per annum, post free, payable in advance.
Applications, with subscriptions, to be sent to the Government Printer, Pretoria.

NOTES.

The Change in the Form of the "Journal."

Mention was made in the November, 1925, issue of this *Journal* of a projected change in the form of the Department's monthly publication. It has now been decided to give effect thereto, and accordingly the present will be the last monthly issue of the *Journal of the Department of Agriculture*. In future it will be issued quarterly (commencing with June, 1926), and will continue to be the Department's medium of publishing the results of its experiments and investigations. It will retain its present title and be comprised chiefly of articles of the nature now being published, with the addition, probably, of certain articles of a more technical nature.

A *monthly* journal will be continued, however, and in order to distinguish it from the *quarterly* journal, will from next month (April, 1926) onwards, be entitled *Farming in South Africa*. It will contain concise, easily read notes, articles, etc., emanating from the Department, the object being to give in a form readily assimilated, information and advice essential to good farming practice under South African conditions. It may be mentioned that in view of the large demand by farmers for the weekly advice leaflets issued by the Department, and proving so popular, it has been decided to publish these leaflets in the *monthly* journal as well, so as to make them available to every farmer in the country.

The above change will be the means of establishing a very comprehensive system of Departmental publicity, as will be seen by reference to the statement, published elsewhere in this issue, under the heading *Publications of the Department*. This system provides printed matter for all classes of readers, which, broadly, comprise (*a*) the ordinary farmer who wants clear and concise matter; (*b*) the semi-technical reader and the non-technical man who studies agriculture; and (*c*) the purely technical reader. *Farming in South Africa* is designed particularly for class (*a*), which contains the large majority of farmers.

The Department is thus fulfilling the important duty of recording and making known the results of its investigations. It expects the farmer to do his share and make an effort to become acquainted with the advice and information made available to him.

Farming in South Africa should be read by every farmer in the country. It will be obtainable on application to the Government Printer, Pretoria, at a cost of 5s. per annum, post free, payable in advance. Arrangements are being made by which it is hoped to secure the services also of all secretaries of farmers' associations and of co-operative agricultural societies in receiving subscriptions on behalf of the Department. It is also expected that all post offices, magistrate offices, as well as certain public officers, will receive subscriptions.

The quarterly *Journal* will be obtainable from the Government Printer, Pretoria, also at 5s. per annum within the Union and South-West Africa, and 6s. otherwise. Present subscribers to the *Journal of the Department of Agriculture* are advised that the monthly publication *Farming in South Africa* will be sent to them unless they advise the Government Printer to the contrary.

The Competition of Artificial Silk.

Many farmers in South Africa have been concerned over the increased use of artificial silk, which they thought might tend to displace wool. Our Trade Commissioner in London, together with Mr. Michaelian, Chief Sheep and Wool Expert of the Union, investigated this matter in England. The consensus of opinion there was to the effect that artificial silk can never be a serious competitor to wool and cotton.

Artificial silk yarn is at present produced on a commercial scale in comparatively coarse counts; very fine yarns have been produced experimentally, and the tendency in the future will no doubt be for fine yarns to be manufactured commercially, particularly for weaving with cotton or wool.

As it was feared that the country's cotton industry was threatened by the advent of artificial silk, investigations were made in America, and in a recent report of a well-known firm, it is stated:—

"From a superficial view it might appear that the growth of rayon (the commercial term for artificial silk) production had taken place at the expense of these other lines (cotton and wool). To a certain extent that had been true at first, but it is a significant fact that artificial silk is now generally regarded as one of the greatest potential aids to the revival of the textile industry as a whole. Rayon has figured and is expected to figure more prominently as a supplement rather than a competitor of cotton and wool."

Another firm stated:—

"Rayon is here to stay. It will not replace cotton, wool, or silk, but will strengthen its position as one of the major textile fibres. It will always be more valuable as an auxiliary material than as a self-fibre. It is unfair to regard it as a competitor. It has and will prove still more to be an important adjunct. It has done more during the recent textile depression in this country to boost the sales of textile than has any other single factor. It has enabled the production of

attractive novelties at a price within the reach of the average pocket book. It could have made no greater or more timely contribution than this to the industry."

From the above it will be seen that since its development in 1912, rayon has been a boon to the cotton industry, has given life to the worsted dress goods trade, is a splendid ally to pure silk, and that its possibilities in this connexion are unlimited.

Artificial Silk and Wool Production.

In 1924 the total production of rayon (artificial silk) in the United States was 38,750,000 lb., the estimated production for 1925 was 54,700,000 lb., and for 1926, 74,000,000 lb. The world's production in 1923 was 97,000,000 lb., and for 1924 was 141,164,000 lb. At first glance such figures do not seem to uphold the above argument that artificial silk can merely be regarded as an auxiliary and not as a competitor of other fibres. But let us compare these figures with the actual demand for wool. In 1923-24 the world's wool production amounted to 2,720,070,400 lb. According to Sir Arthur Goldfinch (Chairman of the London Board of B.A.W.R.A.), writing in the *London Times Trade and Engineering Supplement*, January, 1925, "a standard of consumption has been set up which on the average of years may be conservatively reckoned as exceeding by 12 per cent. the average animal growth." Assuming this basis to be correct, the world-demand for wool amounted to approximately 3,100,000,000 lb., a shortage of very nearly 400,000,000 lb. In 1922, according to the same authority, the demand exceeded the actual quantity produced by 696,000,000 lb. From these figures it would appear that the wool industry need fear no competition on the part of the artificial silk industry, particularly as artificial silk is used to supplement rather than to displace wool.

On close analysis it is difficult to see how rayon can displace wool, which, unlike artificial silk, can absorb and retain heat. But in the mohair trade it might perhaps prove a competitor, as it is now used extensively in figured goods, where mohair was employed in the past. This need not, however, alarm producers of mohair, as this commodity is being used to a far greater extent for commercial purposes than in the past.

Thus taking every aspect into account, it can safely be said that artificial silk has come to stay as a new industry in the textile trade, but not to replace wool, cotton, or mohair.

Rosette of Apricot and Plum Trees.

The attention of fruit growers is directed to a bulletin * recently published by the Department regarding the investigations of Dr. Marloth into (1) the causes producing rosette of apricot and plum trees in the Wellington district; and (2) the influence of alkali soils

* 1. Further investigations into the causes producing Rosette of Apricot and Plum Trees in the Wellington District;

2. Report on some Preliminary Investigations into the Influence of Alkali Soils on Peach Stocks employed for Apricot and Plum Trees, by R. Marloth, Ph.D., D.Sc., Science Bulletin No. 42, obtainable from this Office. Price 3d., prepaid.

on peach stocks employed for apricot and plum trees. The investigations recorded in this bulletin are a continuation of those discussed in a previous bulletin on the subject (Science Bulletin No. 29) and open up a line of research of great importance to the fruit industry.

Dr. Marloth comes to the conclusion that the rosette of the apricot and plum trees in the areas investigated and their chlorotic condition is not of a fungoid or bacterial origin, but is due to a virus and consequently not infectious nor contagious. It is, however, often due to crown gall, which is infectious; and is often associated with a more or less general gummosis of the roots. It is largely caused by unsuitable soil conditions, viz.:—(*a*) Shallowness of soil, poverty of the soil, and absence of humus; (*b*) presence of white alkali (chlorides); and (*c*) a semi-arid climate, viz., often no rain for four or five months.

The remedial measures necessary to deal with these conditions are discussed and also the all-important matter of suitability of stocks. In the latter respect it is demonstrated that a way for controlling the gradually increasing trouble is the use of more resistant varieties of peach or of other kinds of stock for the apricots and plums that are to be planted in orchards with such rather adverse conditions as prevail on the farms investigated.

It is intended to publish at a later date lengthy abstracts from this important bulletin which should be read by all fruit growers, particularly those in the areas concerned. The salvation of affected orchards will be found partly in the cultural and preventive measures to which Dr. Marloth refers in his paper, but principally in the selection of a more suitable stock for the trees.

" A beginning has been made with the work," the author points out; " let the fruit growers take up this line of research and place their industry on a safe basis."

Local Consumption of Union Produce.

Interesting figures are given in the Report of the Cost of Living Committee (1925) * as to how far the food supply of the Union is produced locally and the extent to which we depend on imported food.

It is shown that in the case of maize, maize meal, bacon and ham, butter, cheese, fresh fish, jam, sugar, potatoes, and mutton, South African production accounts, as a rule, for well over 90 per cent. of the consumption. In the case of wheat and canned fruit the proportion of South African products consumed has, on occasion, reached or exceeded 90 per cent., but owing to variations in weather conditions, etc., the proportions show greater fluctuations than in the case of the first-named commodities. The imports of beef and mutton come mainly from South-West Africa and Rhodesia.

In discussing the nutritive values of the different foods, the Report states that meat is an excellent but very expensive source of protein. By the substitution of other foodstuffs which are cheaper sources of protein, the needs of the family could be supplied at much less cost. The example of rice is quoted, in which it is pointed out that it is still largely used in South Africa, and might be replaced to some extent by our own cereals, higher in portein fat and mineral matter and at less cost.

* Publication U. G. 47—'25, obtainable from the Government Printer. Price, 4s.

DEPARTMENTAL ACTIVITIES.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview month by month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Fly Predator of Mint Mealy Bug.—The growing of peppermint on a commercial scale for production of essential oil is not at present a widely spread industry in South Africa, but should be one capable of extension. It was of interest, therefore, to find a large acreage of peppermint at Sir Lowry's Pass with roots heavily infested by a species of mealy bug, the identity of which is at present unknown.

A small fly which is predatory in its larval stage on the mealy bug has been reared from infested roots. The fly belongs to a little known group and has not previously been recorded from South Africa.

From the number of pupae in the soil the fly must be present in considerable numbers.

Investigations by the Western Province Entomologist, Mr. R. W. E. Tucker, are in progress to ascertain whether the fly can keep the mealy bug sufficiently in subjection throughout the year, and so obviate any necessity for soil fumigation or treatment of the roots of plants to obtain control of the mealy bug. From observations made at present, the mealy bug appears to be at its zenith in November and December. In January it has largely disappeared from the upper roots and suckers, and is usually only found, if at all, deeper in the soil on rootlets. Empty fly pupae cases were abundant in the mealy bug remains, and fly larvae and new pupae were found imbedded in the mealy bug colonies on the lower rootlets. The fly may therefore prove to exert an adequate, though not absolute, control over the mealy bug.

Experiments in soil fumigation, root treatment, and cleansing of transplants are also in progress.

Winter Ploughing for Cutworms.—Cutworms are reported to have been extremely bad in high-veld maize-lands this season. Amidst the flow of complaints it was very refreshing to receive a letter from a farmer near Kraal in Heidelberg District, which, as a prelude to a request for information about the stalkborer, stated: "Through following your advice to plough in the *winter*, I have had no cutworms at all the last two seasons and I have to thank you."

Cotton Seed in Phosphate Bags.—Commerce tends to spread the insect and weed pests of one country to every other country, and it is common knowledge that such pests often cause vastly more damage

in a country to which they are introduced, from afar, than in their original habitat. The Department exercises various safeguards against the introduction of new pests, but the safeguards cannot be made perfect without intolerable interference with trade. One of the pests which it is feared may get in, despite precautions, is the notorious pink boll-worm of cotton. This insect goes to rest in cotton seed and may revive after more than a year has passed. The Department is therefore very particular about the entry of cotton seed. But cotton seed in bags is shipped in enormous quantities from many lands to Europe for crushing and the bags are afterwards used for many purposes. Many such bags sent to distant countries are sold to farmers. They commonly still contain some cotton seeds and therefore may carry pink boll-worm. The second-hand empty bags that come to South Africa are at present casually inspected, and bales in which any cotton seeds are found are being excluded from entry. But it is evident that old bags may arrive filled with produce, and the presence of cotton seeds in them may easily escape detection at the port. Recently the inspection of a consignment of 2,800 bags of superphosphate from Holland landed at Capetown revealed cotton seed in some of the bags. Such a find at inspection is liable to make much trouble for the consignee. Importers are advised to caution their oversea suppliers against sending them produce in cotton or cotton-seed bags.

One of the West Indies is supposed to have got pink boll-worm by the flight of moths from a cotton-seed laden vessel. Such an accident is wellnigh unpreventable. Recently the Plant Inspector at Durban observed raw cotton clinging in masses to recently landed timber. On investigation he found the timber had been brought from Liverpool by a vessel which on its previous voyage had taken a cargo of cotton to Liverpool from India.

Eucalyptus Snout-beetle.—It was stated in the last issue that the planting of the Eucalypt *riminalis* as a plantation tree appears to be wholly inadvisable and that the wisdom of continuing to plant *globulus* and *maideni* was gravely questioned. It may now be addel that *rostrata* in one of the Crown Mines plantations is being damaged by the insect to such a serious extent that it seems safe to conclude that this species should be grouped amongst those which should no longer be planted as a plantation tree. In the plantation to which reference is made is a block of about a thousand four-year-old *rostrata* entirely surrounded by *riminalis* trees of the same age. The *rostrata* trees are being ravaged almost as badly as the *riminalis* trees. The tops have been stripped of all their leaves.

While the insect feeds voraciously on newly planted *riminalis*, the juvenile growth of *globulus* and *maideni* has little attraction for it. In certain mixed plantations of these species one to two years old, the insect has picked out the *riminalis* trees and is already bad on many of them, while the *globulus* and *maideni* trees are not yet molested. The trees of the latter kinds still have only juvenile foliage, characterized by profuse waxy bloom and bluish colour. The coppice growth of *globulus* from the stumps of trees that were heavily infested may be very considerably attacked, more especially by the beetles; but the preference of the insect for the adult type of growth is shown as soon as shoots of it appear. The adult growth suffers terribly.

During January experiments in distributing calcium arsenate dust over infested trees by means of an aeroplane were carried on in several plantations. The Air Services of the Defence Department constructed the apparatus and attend to all the aviation phases of the project. A large section of a *globulus* plantation, about 20 miles north of Johannesburg, and several sections of a *viminalis* plantation about 5 miles south of Johannesburg, were dusted. The trees appear not to have been injured by the dust and the treatment was surprisingly effective in destroying the larvae and beetles. The *globulus* plantation had been clean felled in March-May last and the trees as treated were like dense shrubs. The growth was practically all of the juvenile type and about six feet high. The *viminalis* trees were four years old and about 25 feet high. The dust appeared to be blown thoroughly down through the trees. As the machine passes along at 85 miles an hour, or nearly 2,500 yards a minute, and as several rows of trees are treated at a time, the actual dusting proceeds very rapidly; but making the turns at the borders of the plantation and landing for supplies consume a great deal of time. Then only early morning hours are suitable for the work, and morning after morning may pass without the air being calm enough for the operations. At the present time it cannot be said that aeroplane dusting is likely anywhere to prove a profitable means of control for the pest. Much more experimentation will be needed to learn how much dust needs to be applied and how wide a stretch can be done thoroughly in one swath. A safe landing ground within a few miles of a plantation to be treated is one of the necessities for dusting.

About the middle of January the Plant Inspector for Durban found the larva and adult of the eucalyptus snout-beetle on a eucalyptus tree at Sydenham, near Durban. The insect has previously been recorded at the other principal seaports of the Union: Capetown, Port Elizabeth, and East London.

Codling-moth in Loquats.—The Elsenburg Entomologist reports having reared four codling-moth (*Carpocapsa pomonella*) adults from loquats. About forty infested fruits were collected. He states that the larvae burrow into the seeds when the pulp of the fruit dries, almost entirely devouring them.

"Myelois ceratoniae" in Oranges.—Moths of this species have been reared in past years from mummies of apples and other fruits, and from nuts, gathered in various parts of the Union. The Elsenburg Entomologist reports that larvae found in ripening navel oranges at Clanwilliam in May last proved, on rearing the insect to the moth stage, to be this species. In all cases the infestation of the oranges appeared to start at a split in the rind. In December, he observed the insect to be common in acorns at Wellington and also at Orchard (Worcester District).

Woolly Aphis Parasite.—This insect, *Aphelinus mali*, was found abundantly infesting woolly aphis at Drakenstein, Bethlehem, Orange Free State, during January, 1926, by Mr. C. P. van der Merwe. The matter is interesting, as illustrating the natural spread of the parasite, since there is no record of any insects being sent to the neighbourhood of where it has now been found.

Tobacco Insects.—During January Dr. T. J. Naudé continued observations on tobacco slug in the Rustenburg tobacco area. Additional experiment plots were set out in connexion with nematode control and some time was given to investigation on insects attacking seed maize in the soil in the vicinity of Brits and of Rustenburg.

White Ants.—The following letter received from a correspondent at Delportshoop, Kimberley District, is of interest as showing how peach and apricot trees remain immune to termite attack even in what must be considered very adverse circumstances. The white ant concerned is a species of *Ancistrotermes*, and this forms the first record of the existence of this genus in the Kalahari region. Formerly, *Ancistrotermes* has been reported north of the Zoutpansberg and east of the Drakensberg where it extends into Northern Zululand, as far south as the White Mfolozi. The correspondent writes:

"I am sending you specimens of the white ants with a portion of a pear tree which they have killed. The roots of the tree have been eaten off. I planted twenty apple trees, fifteen pear, about one hundred peach and apricot, twenty-five figs, and sixty vines. Of these, six apple trees, twelve pears, seven figs, and twenty-five vines have been destroyed, whilst none of the peaches and apricots have been damaged."

Fruit Blossoms and Moths.—In the course of his report for September, 1925, the Eastern Cape Province Entomologist, Mr. D. Gunn, makes the following observations: "Early in September information was received from a fruit grower at Selborne that fruit moths were injuring the blossoms of almond trees. Subsequently Mr. Bishop visited the district and found that moths of the following species were present in thousands: *Chloridea obsoleta*, *Brithys pancratii*, and *Phytometra* sp. These moths seem to be sucking the nectar from almond tree blossoms, but none of the common fruit piercing species were observed."

False Codling-moth.—From further experiments conducted by the Eastern Cape Province Entomologist in September last it would appear that the False Codling-moth (*Agryroploce leucotreta*) feeds upon poisoned bait and succumbs to the effect thereof. This was confirmed by confining twelve to fifteen moths of both sexes in three cages, that is, cages enclosing branches. The moths in one series of cages were not supplied with food of any sort, and these died after five days. The moths in a second series were supplied with honey and water and live for fourteen to fifteen days. Those placed in the third series were supplied with sweetened poison, but died within two days and four hours, or about half the time that it seemingly took for those without a food supply to starve to death.

A comprehensive timely article on the False Codling-moth by Government Entomologist David Gunn was published in the *Farmers' Gazette* (official organ of the Transvaal Agricultural Union), dated 24th December, and also in the January issue of the *Citrus Grower* (quarterly journal of Sundays River Citrus Co-operative Company). A reprint of the article may be obtained by any interested citrus grower on application to the Division of Entomology, Box 513, Pretoria.

In his article, Mr. Gunn states that out-of-season oranges commonly become heavily infested and greatly assist the insect by providing it with food which carries it through the summer. Since the article was published Mr. Gunn has submitted letters from a number of prominent Bathurst District citrus farmers, giving the degree of infestation in out-of-season oranges as 25 to 75 per cent. in the crop removed this summer. Out-of-season oranges are often very abundant in the Bathurst District.

Citrus Orchard Fumigation.—Under the title "Experiences of a Citrus Fumigator," Daniel J. Roberts, the proprietor of the famous Baddaford citrus orchards near Fort Beaufort, contributed to the January *Citrus Grower* a long and interesting article on cyanide fumigation for red scale. The article also appeared in the *Farmers' Gazette* for 8th January. A reprint may be obtained by any one interested in citrus fumigation on application to the Division of Entomology, Box 513, Pretoria.

Chloridea Obsoleta.—During October, 1925, a considerable amount of evidence was forthcoming to show that this insect, known variously as the tomato-worm, beard-worm of maize, and American boll-worm, was abnormally abundant throughout most of the Union and Rhodesia. From the Cape reports have come related to its attack on ordinary orchard fruits; in the Transvaal and Rhodesia the intensity of the attack was mostly noticed in citrus orchards, or, as in the eastern low country of the Transvaal, in tomato crops.

Citrus Psylla.—In certain Transvaal orchards, during October, 1925, the distortion of the young foliage of citrus by this native species, *Trioza merwei*, was especially noticeable. As, in some instances, the trouble has caused a certain amount of alarm, it will be interesting to notice whether the result of leaf distortion has any unusual effect upon the crop.

Cotton Insect Investigations: Staff.—The entomologists employed on cotton insect problems include the following:—Geo. C. Haines, who is now giving full time to the direction of the work, under the Chief, Division of Entomology. A. J. Smith, who is stationed at Rustenburg and has charge of life-history work, and is giving special attention to the cotton boll-worms. T. C. Cairns, who has been transferred from tsetse-fly work in Zululand and is now stationed at Klaserie, Eastern Transvaal, where he is making a special study of boll-worms in that district. J. S. Taylor, who arrived from England on 9th January, 1926. As soon as Mr. Taylor becomes acquainted with our cotton pests and conditions, he will be assigned a subject for study. The fifth cotton entomologist has not yet been appointed, but it is expected that the post will soon be filled.

Cotton Pests at Rustenburg.—Reporting upon the position at Rustenburg for the first three weeks of January, Entomologist A. J. Smith states:

"Except for the lesser Army-worm, *Laphygma exigua*, which attacked several cotton fields in the beginning of the season, slight damage has been done by insects so far. Only one complaint has been received of surface-beetles and snout-beetles attacking seedling cotton, while observations show a very low infestation by all three species of boll-worms."

The Boll-worm Position.—Up to January, 1926, the reports as to the boll-worm position have been decidedly favourable, and indicate that the spring infestations have been slight. A report from the northern Transvaal states that a heavy mortality occurred among the boll-worms during November. Entomologist A. J. Smith will shortly investigate this matter. Some serious infestations have been reported from Barberton, and a report from Acornhoek states that towards the close of January boll-worm was plentiful everywhere in that area and bud-shedding had already occurred in some of the first planted cotton. On the low-veld farms amongst the mountains through which the Olifants River passes on the west of the Drakensberg, Malips Dritt, and thereabouts, the Assistant Chief noticed large areas under ratooning cotton. Here the trouble has been the drought, and all the fields are in a neglected state. None of the farmers thereabouts knew what boll-worm was, although those in the neighbouring valley of the Mutse-Mopatsi, towards Lydenburg, did.

Cotton Dusting and Spraying.—The question of our control of the cotton boll-worms by dusting with an arsenical is now being followed up more thoroughly. Experiments on small scale by dusting and spraying with many different insecticides have been carried out in the past few years; but most have given very unsatisfactory results. This experience has led to the present attempt to demonstrate whether or not dusting will sufficiently control the boll-worms as to give an increase in yield, sufficient to cover all expenses of the treatment and, at the same time, show a profit. Until this can be proved, it is not advisable for cotton growers to go to great expense in equipment and material in following up this method of control.

Experiments will be conducted this season near Boshoek, Matooster, Mara, Sibasa, Waterpoort, Klaserie, and Barberton in the Transvaal. These are fairly representative of the boll-worm belt of the Transvaal and include localities where boll-worm attacks have been severe. At each centre plots of cotton, growing on uniform soil, are being dusted with calcium arsenate, half of the plots receiving one application and half three applications of the dust. Record is kept of the amount of poison applied and the cost of the treatments. Types of dusters, similar to those used in the cotton fields of America, are being employed. Parallel experiments will also be made with dry bordeaux mixture, and this mixture is also being used as a spray at two places, Klaserie and Barberton. With one exception, Klaserie, these experiments are being carried out by cotton growers under the direction of officers of the Division.

Pine Tree Defoliation.—The larvae of *Nudaurelia cytherea* having occasioned some damage to a number of pine trees in a plantation near Port Elizabeth, the matter was investigated by the Eastern Cape Province Entomologist, Mr. David Gunn, who reports that: "Upon investigation it was found that about two hundred young trees, varying in height from four to ten feet, had been partly or wholly defoliated in a section of the plantation which happened to be sheltered from the wind. The caterpillar is a conspicuous creature which, when fully grown, is between three and four inches long, and of a very noticeable coloration of bright blue and red on a velvety-black background. A number were found to be attacked by a parasitic wasp, the larvae of which, when full-grown, emerge

from the body of the caterpillar and spin their cocoons on its back and sides. Some caterpillars were found attacked by a dipterous parasite, a tachinid, which emerged in fair numbers early in January.

In controlling this insect, without resorting to spraying or dusting the infested trees with arsenicals, two methods were shown to be of practical use: (1) the infested trees were vigorously shaken, the caterpillars readily fell to the ground, where they were collected and destroyed; (2) after the caterpillars had matured and had entered the soil, the pupae were collected by turning over the soil with garden forks and exposing them. In adopting this method it was observed that fully 80 per cent. of the pupae were destroyed.

Stinkvlieg.—The common stinkvlieg, *Nysius binotatus* Germ., seems to have been extraordinarily numerous during January, as reports of severe infestations of the pest were received from various parts of the Orange Free State and Natal. Potatoes were most severely infested, but other vegetables, garden flowers, and fruits were also attacked. The attack on peaches was especially severe. At times it was not possible to approach the trees to pick fruit as the insects were so numerous, and the peaches were rendered soft and unfit for use owing to the feeding of the insects.

"Anthrenus" Attacking Woollen Goods.—A clothing firm in Pretoria reported that woollen goods in their show window were being eaten by insects. On examination many larvae of *Anthrenus verbasci* L. were found. The attack on the woollen goods, however, proved to be merely secondary. The origin of the infestation was found in the large number of dead insects of all kinds which had collected at the fan-lights above the show-windows, attracted thereto by lights. Dead insects are a favourite food for *Anthrenus* larvae, and of the large numbers breeding on the dead insects, some fell through into the show-windows; here, not having any other food, they attacked the woollen goods which were the only other form of animal matter available as food.

Pink Boll-worm of Cotton in Nyasaland.—The Division has been officially informed by the Department of Agriculture, Zomba, that the pink boll-worm has been found in the northern extremity of the Protectorate. The message states that drastic control measures are being taken. The region concerned has only water communication with the southern districts, and a belt of 150 miles of non-cotton country lies between the areas. Cotton culture must cease in the infested area, and has been prohibited in the intervening country.

DIVISION OF EXTENSION.

Home Industries Clubs.—In the January, 1926, issue of the *Journal* mention was made of the establishment at various centres in the western districts of the Cape Province of home industries clubs. The support given to these clubs has been very encouraging. The first was established at Somerset Strand about eighteen months ago. Since then progress has been steady, and the number of members has shown a considerable increase. At a lecture by the Officer of Home Economics, stationed at the Elsenburg School of Agriculture, there were over forty members present, some of whom came from Somerset West.

The success of these ventures depends to a considerable extent on the keenness and personality of the president, secretary, and other members of the committee, and in this respect the Strand club has been fortunate. The programme of meetings and proposed work is arranged a year in advance. The demonstrations and lectures are given by the members themselves in subjects such as sweetmaking, puff pastry, icing, artificial flowermaking, etc., assisted by an occasional lecturer from an outside source. It is proposed shortly to hold a show, the proceeds of which are to be devoted to local child welfare work. Somerset West has been watching the Strand Club's activities for the last year, and has now decided to form its own club.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

POTCHEFSTROOM, TRANSVAAL.

Crops for Winter Feed.—Owing to the unfavourable season, many farmers now face the prospect of having little feed or grazing for their stock during the coming winter. Should February and March rains prove favourable, however, something can still be done to provide succulent feeds for this period of scarcity.

Rape and its close relatives, kale and chou-moellier, can be sown in March, and in warmer localities even in April, if soil moisture conditions are right. Rape does best on a fertile soil, and so far seems to have given the best results when sown alone. Sow from two to three pounds per acre in drills 2½ feet apart or three to four pounds per acre broadcast. It is an excellent grazing crop for pigs, and also to some extent for sheep and cattle. It is also valuable as a soiling crop. Sheep and cattle should become gradually accustomed to the crop, as there is a danger of bloating if they are allowed to graze freely at first. Rape is fairly quick maturing, and under favourable conditions may be pastured two months from planting.

Farmers who intend planting winter cereals should now begin to prepare the fields for these crops. Rye and oats in particular can now be sown for winter grazing. These are valuable crops in this respect, and, provided good rains fall in February and March, will give good returns even on dry lands. Sowings of these for grazing only can now be made, to be followed later by the main crop, which can also be grazed to some extent.

Mutton Prices and the Future.—The farmer often inquires as to the best time of the year for marketing his various kinds of stock. Some find that it pays them better to sell at the end of summer when the animals are fed off the veld, while others prefer to get the top prices with the help of winter-feeding.

It was the general belief that mutton obtained the best prices from August to December. This year has, however, proved a complete contradiction. In July last prime mutton was sold for 9¼d. per lb., whereas in December the price was only 6½d. However good the veld may have been during the last winter, one would at least have

expected that the price would remain high, instead of which a slump has taken place—the Christmas week demand was not even enough to elevate it for a short time.

What will the future bring? From all sides we hear of a good sheep season, and we now enter upon the time of the year when mutton usually fetches poor prices. Is our stock of mutton sheep reaching saturation point and the supply exceeding the demand for home consumption? If this is the case, it is surely time that a higher class of sheep is bred with a view to exporting to oversea markets.

GLEN, ORANGE FREE STATE.

Meat-meal as a Maize Supplement in Pig Feeding.—Many farmers attempt to raise pigs on a diet consisting of nothing but maize. Where this practice is followed, the results will not be satisfactory. Maize alone is not a satisfactory ration for young pigs. If the maize can be supplemented by separated or butter milk, then good results will be obtained. But if milk is not available then some other supplement rich in "flesh-forming" constituents should be added, such as meat-meal, blood-meal, oil-cakes, etc. Recent experimental work at Glen indicates that meat-meal gives good results and that it is an economical supplement. One lot of pigs was fed on maize-meal only, and another on maize-meal plus 10 per cent. of meat-meal. Each lot received green food regularly. Briefly, the results were as follows:—The maize and meat meal pigs consumed 12.3 per cent. less grain and made 7.8 per cent. more gains than the maize-meal lot, and the cost of one pound of gain was 23.6 per cent. less for the former than for the latter lot.

Germination Tests.—Few things required by the farmer are of greater importance than good seed, and yet it is not uncommon to find little attention being paid to its selection and purchase. The expense of preparation of the land is the same whether good or bad seed is used, and the cultivation and management of the crop, whether large or small, is nearly the same. It is therefore important that the best seed obtainable should be sown. There are many points to consider in the determination of the quality of seeds, the two main being purity and germination capacity. The presence of impurities decreases the value of a sample in so far as the purchaser pays for what he does not require. For instance, 6 lb. of teff sown on 1 acre will contain about 12 million seeds capable of germination; if only 1 per cent. of these is weed, it means the possibility of between 20 and 30 such plants on each square yard of ground.

No seed should ever be sown without first having its germination capacity tested. The simplest method which can be used for many seeds is: Moisten a piece of blotting-paper and place it on an ordinary plate. Take 100 seeds, distribute them fairly evenly on the blotting-paper, and cover them with another sheet of similar paper. Then the whole should be covered with another plate turned upside down, placed in a warm room, and kept moist. As the seeds germinate they should be removed once a day. A period of ten days is usually allowed for most seeds, such as cereals, clovers, peas, and turnips; fourteen days for carrots, parsnips, mangels, etc., and twenty-one days for all grasses.

The germination capacities of a few common farm seeds are:

LUCERNE (*Medicago sativa*).—In the finest samples this is about 98 per cent., and anything lower than 90 per cent. should be avoided.

MANGEL (*Beta vulgaris*).—Three or four seeds are usually present in each cluster, but they are rarely all equally well developed. One hundred seed clusters of a good sample usually give over 180 plants; those of average merit about 130 or 140.

BUCKWHEAT (*Polygonum fagopyrum*).—The germination capacity in good samples is usually about 85 per cent.

In barley and wheat it is about 95, in oats 93, and in maize 92 per cent., and any samples that test appreciably below these percentages lose accordingly in value, and should be planted proportionately thicker.

Irrigable Soils.—All soils are not suitable for crop production under irrigation—not even when plenty of good irrigation water is available. Yet, in spite of this well-known fact, the failures of irrigated crops—and even of irrigation schemes—are more often than not attributable to unsuitable soil conditions, simply because such important soil factors as depth and physical composition have not been duly regarded before irrigation was commenced. A soil may be rich in plant food—may have the desirable dark colour which pleases the gardener's eye—and yet be lacking in the most fundamental properties which determine its crop-raising power, namely, its *physical composition* (which includes texture, permeability to water, etc.) and *depth*.

A fine-grained, i.e. "heavy," soil is usually rich in plant food but poor in respect of absorption of and permeability to water. Plant roots develop only to depths where water and air are accessible. If the soil does not "take" its water readily and to the required depth, the irrigationist experiences many difficulties in raising crops; and often the difficulties experienced with such soil conditions are insurmountable. "Prevention is better than cure" in this case. In other words, prudent selection of soil is a key to success in irrigation farming.

Depth of soil (i.e. depth of fertile, permeable soil) is as easily inspected as it is an essential condition for the successful growth, especially of deep-rooted crops. Still, it sometimes occurs that after much expenditure and labour, irrigated lucerne is found to fail on account of *shallowness* of soil.

Brak is often another cause of trouble to the irrigationist, but in most cases *only* when the soil is heavy or lacking in depth. In a deep, permeable soil brak can always be combated successfully when the water supply is suitable.

Hence the prospective irrigation farmer, before launching an irrigation scheme or buying ground for irrigation purposes, should examine the soil more than superficially, and make sure that it is physically suitable for his purpose.

Special Nine Weeks' Course for Wool-Classers.—A special course for the training of wool-classers will be conducted at the Glen School of Agriculture, commencing on the 7th April and lasting for nine weeks. The object of this course is to provide those farmers who have already had experience of sheep farming with an opportunity of acquiring the knowledge and experience that will enable them to class

their own wool and that of other farmers. There are many sheep farmers to-day who know a good deal about sheep and sheep farming, but who have not the requisite knowledge to enable them to class their clips properly; they, furthermore, have not the time available for the two-year diploma course at Potchefstroom, Grootfontein, or Glen, nor for the eight months' special course in sheep and wool at Grootfontein. To these the nine weeks' course at Glen, arranged during a comparatively slack time as far as the sheep farmer is concerned, will appeal.

The Department realizes that the sheep experts in its service will never be sufficient for the classing of all the wool in the country, and that the only salvation lies in farmers qualifying for and performing this service in respect of their own and their neighbours' clips. The instruction will consist very largely of practical work and demonstrations in the sheep-shed. The candidates will be restricted to about twenty.

Full particulars of this course can be obtained on application to the Principal of the School.

A Frost and Drought Resisting Grass.—*Phalaris bulbosa* is one of the few grasses which have proved successful here. The chief value of the grass lies in the fact that it is frost resistant, and fairly drought resistant. The principal objection to the grass is that it is comparatively expensive to establish. Planting out by hand is generally practised; fortunately the grass grows readily, provided the soil is not too poor or dry. A new plot was successfully established by planting out last June prior to irrigating, although summer planting is advocated.

It is advisable to try a small plot of the grass, and if successful to use this for planting a larger area. The plants form large stools which can be broken up when planting out. Do not plant too closely, but allow for inter-row cultivation, for the plants respond well to this treatment.

Frost Resistance of Spineless Cactus Varieties.—A young spineless cactus plantation, consisting of rows of eleven varieties planted in triplicate, and situated on an incline, has afforded a good opportunity of studying the frost resistance of these varieties. The lowest temperature registered last winter at the meteorological station, a few hundred yards away on slightly higher ground, was 20.2 F. or 11.8 degrees of frost on the 14th of June, 1925. An inspection of the plants on the 26th of that month showed that the varieties *Muscatel*, *Ficus indicus*, and *Korfu* had suffered most. The most resistant varieties were *Fusicaulis*, *Algerian*, and *Morado*. At about this time, black areas resembling a black rot disease commenced to develop on some of the leaves; it was, however, impossible to discover any disease organism in the affected parts, or to transmit this by inoculation, and it would appear, therefore, that it was due to frost. This attack in some instances was very severe, the majority of plants in some rows of the varieties *Ficus indicus* and *Muscatel* being killed or seriously injured. The affected parts, which often included whole leaves, later dried and dropped off.

It is interesting to note that the plants in the lower lying part of the plantation suffered most. Obviously much can be done to decrease the danger of frosting by planting on the higher lying ground, or on areas which are well air-drained.

ELSENBURG, MULDERS VLEI, C.P.

Budding.—Any young or old trees that have been previously cut down in preparation for budding, may still be worked over during this month. Where possible, it is advisable to select dull, cool weather for this work, so that the sap may run more freely and the weather will not have too drying an effect on the newly inserted buds. To secure success, the sap must be running freely. Consequently, when the cuts are made, the bark should " run " freely and without tearing or clinging of the fibres, and it should separate freely from the wood. The buds selected should be firm, well matured, and show no signs of premature decay, and should be taken from healthy trees which are known to yield good crops of fruit. A smooth, clean spot is selected on the bark of the stock and a T-shaped cut made, the vertical cut being slightly longer than the horizontal one. The bark at the point where the cuts meet should be slightly raised and the bud inserted between the bark and the wood of the stock. The bud is then gently pressed down into position. If the bud is found to be too long for the rest, the top may be cut off level with the horizontal cut. To make certain that the bud comes in close contact with the stock and to prevent it from drying out, it is necessary to tie the wound round the bud, using soft twine, tape, or raffia.

After two or three weeks the buds may be examined to see if they have " taken," i.e. to see if they have thoroughly united with the stock. When this occurs the ties can be removed. The buds will remain in a dormant condition throughout the autumn and winter till next spring. The branches or lateral growth above the bud is not cut off but left on until the usual winter pruning, when the head of the tree or stock can be removed.

Summer Pruning.—In cases of fruit trees having made very vigorous growth during the season, it will be found that such growth can be more economically utilized by summer pruning, particularly in cases of the pear, apple, plum, and apricot, and as it is getting late in the season for this work, the sooner it can be attended to the better.

Care should be observed that as much of the leafage as possible is retained on the trees. Any unduly long laterals on fruiting trees thrown out in the centre of the tree or from the outer branches may be shortened back, making certain to cut back over a leaf bud in all cases. Unnecessary terminal growth, of which there may be three or four, all strong growths, may be reduced to one, retaining the strongest and best placed one as the permanent leader. This growth must not be cut or interfered with. Where peach trees have been making excessive growth and refusing to yield a crop in spite of the fact that they have bloomed profusely, it would be advisable to thin the lateral growth heavily during the summer and reduce the leaders to one, allowing this leader to remain untouched. Most of this trouble is due to the trees becoming overcrowded with growth, the central and lateral wood not getting sufficient light and air to bring it to maturity before the dormant period sets in. This work should be attended to at once.

Co-operative Manurial Grain Experiments.—The question of soil fertility is of the greatest importance to the farming industry. The full meaning of the term "soil fertility" is not easily expressed, since many conditions are involved, all of which exercise more or less influence. Among the more important of these influencing conditions is the maintaining of the productive capacity of the soil by the use of commercial fertilizers.

There is no question as to the desirability of the use of commercial fertilizers by the grain-farming community in the area served by Elsenburg, but the methods now generally practised are such as to indicate the very great need of a better understanding of what the functions of a fertilizer are, of the terms used to express their composition and value of the kind that shall be used, and the time, rate, and method of application for different crops under the varying conditions of soil and climate that exist in the western and south-western districts of the Cape. It is necessary to their right use that those who apply fertilizers to their land should have a clear conception of the principles involved in the fertilizing of soil in order that they may intelligently increase their production.

An investigation of the most economical and profitable fertilizer treatment of the soils of our large grain-producing areas has long been regarded as an essential and important educational factor for the progress and welfare of our grain-farming community, and in 1923 a series of co-operative manurial experiments were accordingly initiated by this Institution, which have as their object the testing out of the most suitable combination of fertilizers to use in the various grain-growing areas served by the School.

Some idea of the work involved in the establishment of these experiments, and harvesting and thrashing can be obtained from the following facts:—

During the past season nineteen experiments were established in the following grain-producing areas:—Darling-Hopefield area (two experiments); Piquetberg-Moorreesburg area (two experiments); Malmesbury area (two experiments); Stellenbosch area (two experiments); Caledon-Bredasdorp area (six experiments); Swellendam area (four experiments); Villiersdorp area (one experiment).

Each experiment contains fifteen plots, each plot being one-tenth acre in area. The accurate making up and weighing of the various fertilizer applications for each experiment is carried out at Elsenburg, and then conveyed by means of a motor-lorry to the farms selected for the experiment work. As far as possible the experiments are established on soils which are thoroughly representative of the grain soils of the area concerned.

After the experiment range has been measured and pegged out, the fertilizer mixtures are applied, and the range is then sown and ploughed.

During the past season approximately 800 miles were travelled in the establishing of the various experiments for the purpose of making seasonal observations. All the experiment plots are visited during the spring. The harvesting of the experiments, which obviously requires to be carefully conducted, is carried out under the personal supervision of officers of the School. The pathways

separating the plots from one another have first to be measured up, and are then cut out by means of sickles. The plots themselves are harvested with a harvesting machine, and the sheaves are carefully stacked for the subsequent thrashing operations.

The thrashing of the crops from experiment plots involves a further visit to the farms concerned with the portable thrashing outfit,* and before thrashing the total grain and straw yield from each plot is recorded, so that after thrashing, when the grain yield for each plot is obtained, both the straw and grain yields are on record, the straw yield being calculated by difference.

In carrying out this work in connexion with the past season's co-operative fertilizer experiments approximately 3,000 miles were covered. While these results have yet to be compiled and analysed in detail, they are in their broad outline very satisfactory. In nearly all the experiments certain of the fertilizer mixtures have given consistent and encouraging results, and they will undoubtedly add materially to the knowledge that is being annually obtained.

CEDARA, NATAL.

The Hand-rearing of Commercial Dairy Calves.—The actual feeding of the calf begins before it is born Poorly cared-for cows usually give calves weak at birth and difficult to rear. By giving the calf a fair start in life, its subsequent feeding and care is made much easier and results in a more thrifty animal.

There is some difference in practice with regard to the time to begin hand-feeding. Some take the calf away from its mother at once without allowing it to nurse at all. Others allow it to nurse once, while others prefer to leave it with its mother for several days. The calf is sometimes weak at birth and should have nourishment as soon as possible. It is usually easier to induce the calf to suck the cow than to try to make it drink from the pail. If the cow's udder is normal it makes little difference, but the longer the calf sucks the more difficult it will be to teach it to drink.

The first milk, or colostrum, of the cow possesses properties especially suited to the requirements of the calf. It acts as a physic and stimulates the stomach of the calf and other digestive organs to action, and should therefore always be given to the new-born calf.

Under natural conditions the calf takes its milk frequently and in small quantities. In hand-feeding the quantity the calf needs depends upon the size and age of the calf. For the first two weeks, from 6 to 12 lb. of milk, depending upon the size and vigour of the calf, should be allowed per day, and best in three feeds. At about three weeks of age, the number of feeds may be reduced to two a day, and somewhat more milk given. At this time the substituting of skim for whole milk may begin. This substitution must take place

* A description and photographs of this portable thrashing outfit appeared in the April, 1925, number of the *Journal of the Department of Agriculture.*

slowly and very gradually, and may be completed when the calf is about six weeks old. At this age the amount of skim milk required will vary from 12 to 18 lb. A large calf may get as much as 20 lb. It is safer to keep the calf a little hungry. This will keep it in a more thrifty condition. Over-feeding is undoubtedly one of the most common causes of indigestion and scours. Each calf should be fed separately to ensure each getting its share.

The milk must always be fed clean, fresh, and warm—as close to the condition in which nature furnishes it as possible.

The calf should be taught to eat grain as soon as it will take it, which is at an age of three to four weeks. The grain is best fed dry and after feeding the milk. If the calf does not begin to eat grain when it should it can be taught by putting some grain into its mouth after the milk is fed. This grain feeding helps to stop them from sucking each other, and also replaces the butter-fat which has been removed from the milk. The grain should be fed in small quantities and not left before the calf all the time, as the grain becomes stale. Give just as much as the calf will clean up readily, not more than half a pound per head per diem up to eight to ten weeks old, and from this till weaning time a pound per day will be sufficient under average conditions. The grain for calves may be made up out of the following:—Crushed mealies, wheaten-bran, ground oats, and monkey-nut meal or linseed meal.

The following are a few mixtures:—Three parts crushed maize, one part wheaten-bran, one part crushed oats; three parts crushed maize, one part wheaten-bran, one part crushed oats plus one part nutmeal or linseed meal.

The feeding of hay should begin about the same time as the feeding of grain, and can be kept before the calves all the time.

Water is essential even to calves on a milk diet. They should have an opportunity at least once a day of getting all the fresh water they desire. Stagnant water is a source of intestinal disturbances, and calves should be kept away from such water.

Salt and bonemeal should also be provided as soon as the calves are old enough to consume hay and grain.

Two very important considerations in calf feeding are cleanliness and regularity.

Cleanliness is absolutely essential to the successful rearing of calves. It is equally necessary in feed-pens, bedding, and utensils. All milk fed should be fresh and clean, as also the other feeds. Calf-pens should always be kept clean and filled with plenty of dry bedding. Great care should be taken in washing the milk-pails. These should be thoroughly scalded and aired in direct sunlight. Discarded feed should be removed from the feed-boxes, which should be thoroughly brushed and cleaned out every day. Attention to these details is the best preventive of disease. Nearly all disorders and diseases of the calf are caused either directly or indirectly by lack of cleanliness.

Regularity in the time of feeding and quantity fed is equally important. The periods between feeds should be as nearly equal as possible and the amounts the same. The importance of regularity cannot be over-emphasized.

PUBLICATIONS OF THE DEPARTMENT.

A Comprehensive Educative System.

THE Department depends largely on its publications to give practical effect to its labours, and the following outline of its organization in this respect will show that it possesses a comprehensive system of publicity and uses every possible means of reaching the public. The system outlined will operate from April, 1926, when the form of the present monthly *Journal* will be changed and its name altered to *Farming in South Africa*.

(1) *The Journal of the Department of Agriculture* is published quarterly and contains articles and reports, in addition to other matter, written by the various officers of the Department. Its contents are in some respects of a semi-technical nature, but generally it is composed of sound, practical articles on various agricultural subjects. Its aim is to record the investigations and pronouncements of the Department and to meet the needs of the student of agriculture, whether he be actually on the land or engaged in work connected with the industry. In it is published also the Annual Report of the Department. This publication provides the nucleus of South African agricultural literature. It is also the principal medium in the wide exchange of printed agricultural matter effected between the Union and other countries; in this way it serves the purpose of indicating to the world the high standard of organized agriculture in South Africa. It is comprehensively indexed and forms a valuable record of the agricultural progress of South Africa, besides being suitable as a textbook of agriculture.

(2) *Farming in South Africa* is published monthly for the purpose of acquainting the farming community (particularly those who do not read the quarterly *Journal*) with the results of the Department's experiments, etc., and other information it requires to make known. It includes practical advice on the various problems that face the farmer in South Africa and, among other features, contains summarized versions of the articles published in the quarterly *Journal*. It is the Department's chief means of keeping in close touch with farmers generally.

(3) *Science Bulletins*: It is necessary to publish from time to time special papers that are too scientific and lengthy for inclusion in the quarterly *Journal*. These are numbered consecutively and comprise the series of publications known as "Science Bulletins." Whenever such a bulletin is issued it is reviewed in the quarterly and monthly *Journals*, so that the public is duly advised of these special publications.

(4) *Other Bulletins*: There is occasion also to publish special articles and reports that are more or less non-technical but too lengthy for inclusion in the quarterly *Journal*. Like the "Science Bulletins," these are numbered consecutively and are reviewed in

the two *Journals*. They are named "Bulletins" (in contra-distinction to "Science Bulletins") and form a separate series of departmental publications.

(5) *Reprints*: The Department receives a great many applications for printed matter dealing with various agricultural subjects, and to meet this demand large numbers of bulletins (some at a small charge and others gratis) are distributed. A list of these bulletins is supplied, free of charge, to applicants. This list contains certain of the science and other bulletins mentioned in (3) and (4) above, but mainly comprises "Reprints," that is, articles published in the two *Journals* and reprinted in pamphlet form. Many farmers require these pamphlets for easy reference, though it will be seen that regular readers of the *Journals* are kept posted with the full range of publications of the Department and of the advice it offers on all matters falling under its purview.

(6) *Weekly Advice Leaflets*: Every week a leaflet is published giving plain, practical, and seasonal advice on various agricultural subjects. These leaflets are sent to all officers of the Department who come in touch with farmers, and are used for word-of-mouth instruction to those farmers who are not sufficiently interested in the Department's publications to obtain or read them. They have a wide distribution, including the Press, all post offices, and magistrate offices, farmers' associations, and all school teachers in rural areas. They are published also in the monthly *Journal*, and by this means are available to every farmer in the Union who wishes to have them.

7. *Crops and Markets*: This bulletin is published monthly and gives the latest information on the crop position, ruling market prices, and marketing intelligence generally, both in the Union and oversea countries. It is compiled by the Division of Economics, Markets, and Co-operation, and is sent gratis to all the Department's crop correspondents, the Press, and others interested.

(8) *Special Press Service*: Reports and other intimations which require early publication and are of public interest are sent direct to the whole Press of South Africa, whether daily or otherwise, and including all papers devoted to agriculture. This matter is issued as soon as to hand, and is a branch of publicity that it is intended to expand as time goes on.

(9) *Farmer's Handbook*: It is proposed to publish a farmer's handbook that will be a handy book of reference on the farm. The proposal has still to be given effect to, and it cannot be stated yet when the book is likely to be available.

DIVISIONAL PUBLICATIONS.

In addition to those mentioned above, certain special publications of a highly technical nature are issued under the direct supervision of the Department's Divisions referred to below, as follows:

(1) *Division of Veterinary Education and Research*: This Division publishes its own scientific reports. The last report to be issued was the Ninth and Tenth (distributed in July, 1924), while the Eleventh and Twelfth Report is due to be published at an early date. The report has a special distribution list, and a limited number

of copies are also for sale. All articles in the last-mentioned report of direct interest to the farmer have been referred to in the Department's *Journal*.

(2) *Division of Botany*: This Division is responsible for the publication of "Bothalia" and the "Memoirs of the Botanical Survey of the Union of South Africa," both edited by Dr. I. B. Pole Evans, C.M.G., the Chief of the Division of Botany and Director of the Botanical Survey.

(*a*) "Bothalia" is intended primarily as the medium for the publication of papers and monographs based on the material in the National Herbarium, presenting new facts and items of general interest. Further particulars regarding the publication may be found in the Department's *Journal* of July, 1921.

The first number of "Bothalia" was published in January, 1921. Since then four parts have appeared which form the first volume. The articles published deal mainly with taxonomic work which has been undertaken as the result of repeated inquiries from other Government Departments for correct information as to the specific identity and distribution of particular plants.

The papers which appear in the first volume are:—By *Dr. E. M. Doidge*: (1) South African Ascomycetes (Parts I-III). By *Dr. E. P. Phillips*: (2) A fungus of Economic Importance on the Avocado; (3) Species of *Elephantorrhiza* in the South African Herbaria; (4) The genus *Bersama*; (5) A revision of the genus *Sesbania* (with J. Hutchinson); (6) The Natal species of *Sapindaceae*; (7) The Thorn Pears; (8) The genus *Ochna*; (9) The genus *Olinia* (with Miss J. Hofmeyr); (10) The genus *Cyclopia* (with Miss J. Hofmeyr). By *S. M. Stent*: (11) South African Gramineae, (*a*) A new genus and seven new species, (*b*) Grasses of the Transvaal as represented in the National Herbarium. By *E. G. Baker, F.L.S.*: (12) Revision of South African Species of *Rhynchosia*. By *N. E. Brown, A.L.S.*: (13) The genera *Aloe* and *Mesembrianthemum*.

(*b*) *Botanical Survey Memoirs*: These memoirs deal with every aspect of botanical science that will assist in extending our knowledge of the natural vegetation of South Africa. The objects of the survey are outlined in the Department's *Journal* of May, 1920. Its establishment is one of the direct scientific results of the Union of South Africa.

The contributors to the "Memoirs" up to the present have been chiefly members of the Botanical Survey Committee, while the staff of the National Herbarium, Pretoria—the central herbarium for the survey—undertakes the naming and recording of specimens, e.g. as in the case of the contributions of Mr. Galpin and Messrs. Aitken and Gale.

Up to the present, six memoirs have been published and four are in press, the subjects dealt with being as follows:—No. 1, by *Dr. S. Schonland*, Phanerogamic Flora of the Divisions of Uitenhage and Port Elizabeth; No. 2, by *R. D. Aitken, B.Sc.*, and *G. W. Gale, B.Sc.*, Botanical Survey of Natal and Zululand; No. 3, by *Dr. S. Schönland*, South African Cyperaceae; No. 4, by *various contributors*, Guide to Botanical Survey Work; No. 5, by *Dr. J. W. Bews*, Researches on the Vegetation of Natal, Series 1; No. 6, by *Dr. E. M. Doidge*, A Preliminary Check List of Plant Diseases occurring in South Africa; No. 7, by *E. E. Galpin, F.L.S.*, Native Timber Trees

of the Springbok Flats; No. 8, by *Dr. J. W. Bews*, Researches on the Vegetation of Natal, Series 2; No. 9, by *Dr. E. P. Phillips*, Poisonous Plants of South Africa; No. 10, by *Dr. E. P. Phillips*, Genera of South African Phanerogams.

(3) *Division of Entomology*: The publication of the series of "Entomology Memoirs" under the auspices of the Division of Entomology meets a definite need. It is the South African medium for publishing entomological contributions to knowledge of a scientific or technical nature by the growing body of entomologists in the service of the Government. The memoirs form a carefully presented record of investigations or research on entomological subjects by persons in (or closely associated with) the Department of Agriculture. Three memoirs have already been published, and a fourth is now in course of publication, viz.:—No. 1: By *Claude Fuller*, Tsetse in the Transvaal and Surrounding Territories. No. 2: by *H. L. Munro, B.Sc.*, Fruit-flies of Wild Olives; by *Dr. F. W. Petty*, South African Psyllids, Orchard Spray Experiments; by *Claude Fuller*, The Thorax and Abdomen of Winged Termites: White Ant Experiments. No. 3: By *Dr. L. B. Ripley*, Experiments with Cutworm Baits: Success with Sodium Fluoride; by *R. W. E. Tucker, M.A.*, The Black Sand Mite—*Penthaleus Destructor* N. Sp.; by *H. K. Munro, B.Sc.*, Biological Notes on South African Trypaneidae (Fruit-flies) 1. No. 4: By *Dr. T. J. Naude*, Cicadellidae of South Africa.

HOW TO OBTAIN DEPARTMENTAL PUBLICATIONS.

Both the quarterly and monthly *Journals* [referred to in (1) and (2) above] are published in English and Afrikaans and are obtainable from the Government Printer, Pretoria, and railway bookstalls. The annual subscription for each is 5s. per annum within the Union and South-West Africa (otherwise 6s.) post free, payable in advance.

The various bulletins and reprints [referred to in (3), (4), and (5) above] are obtainable from the Editor, *Journal of the Department of Agriculture*, Pretoria, who, on application to him, will furnish, free of charge, a list of such as are available for distribution. Some of these publications are issued free of charge, and the others at a small charge, prepaid, as will be indicated on the list referred to.

The Weekly Advice Leaflet has a special distribution, but is also available to every individual through *Farming in South Africa*, in which it is published every month.

Application for the "Crop and Market" should be made direct to the Chief, Division of Economics, Markets and Co-operation, Department of Agriculture, Pretoria.

The Reports of the Director of Veterinary Education and Research are obtainable from the Government Printer, Pretoria, at a charge of about 10s. per volume.

The "Bothalia" and Botanical Survey Memoirs are supplied by the Chief of the Division of Botany, and by the Government Printer, Pretoria. The price of the former (volume 1) is 7s. 6d. per copy, and that of the various memoirs ranges from 1s. 6d. to 20s. per copy.

The Entomological Memoirs are stocked by the Chief, Division of Entomology, and the Government Printer, Pretoria, from whom they may be obtained at 2s. 6d. per copy.

WEEDS OF SOUTH AFRICA.

By K. A. LANSDELL, Botanical Assistant, Division of Botany, Pretoria.

XVIII.

[Like other countries, South Africa is awaking to the importance of suppressing its noxious weeds, which, owing to the alarming rapidity of their spread in recent years, are becoming increasingly dangerous to our pasturage, wool, and other agricultural pursuits. While much has been done in the past to place the farmer in a position to recognize and cope with the danger, the problem grows in seriousness, and the time has arrived when all information regarding the noxious weeds found in the Union should be gathered into one publication for the use of the farmer, the student, and the general public. This work has now been undertaken by the Division of Botany, the opening contribution, continued hereunder, appearing in our April, 1921, number. The publication, which includes an illustrated glossary on the morphology of weeds, is the first of its kind in South Africa, and will continue to appear in serial form in the *Journal*. Thereafter, the series will be reprinted in bulletin form, with the addition of a coloured plate illustrating each weed dealt with.—EDITOR.]

Weed No. 13.

THE BLESSED THISTLE (*CARBENIA BENEDICTUS* L.). Order *Compositae*.

THE "Blessed Thistle," botanically known as *Carbenia benedictus* L., is a native of Asia and the Mediterranean Region. In South Africa this weed has so far only been recorded in the Pretoria District, Transvaal. It is found mostly in pasture lands, roadsides, and waste places, and is reported to be very troublesome in lucerne fields. The "seed" or achene is oblong, ridged, with a scar at the base, blackish in colour; the apex is tipped with a pappus which is in two rows—the inner row of short fine white hairs, the outer row of stiff cream-colour bristles, about twice as long as the inner row. (Plate I.)

The "seeds" may be disseminated in various ways, e.g.:—

(1) As the plants grow in cultivated lands the "seeds" may be harvested with the crop and be present as an impurity.

(2) At the apex of the "seeds" are attached numerous hairs which enables them to be blown about by the wind. (Plate I.)

(3) They are carried down stream by flood-waters and deposited on the banks of rivers, where they germinate and form new infected areas.

The following results show the germinating capacity of the "seeds":—

No. of Seeds Planted.	Date Planted.	Date Radicle Appeared.	Date Cotyledon Appeared.	Germinating Capacity.
100	21st July, 1921	7th August, 1921	11th August, 1921	82 per cent.

The "seeds" were placed in sawdust on the 21st July, 1921, in the green-house. The radicle began to appear seventeen days after planting (Plate II, Fig. 11) and the cotyledons twenty-one days after

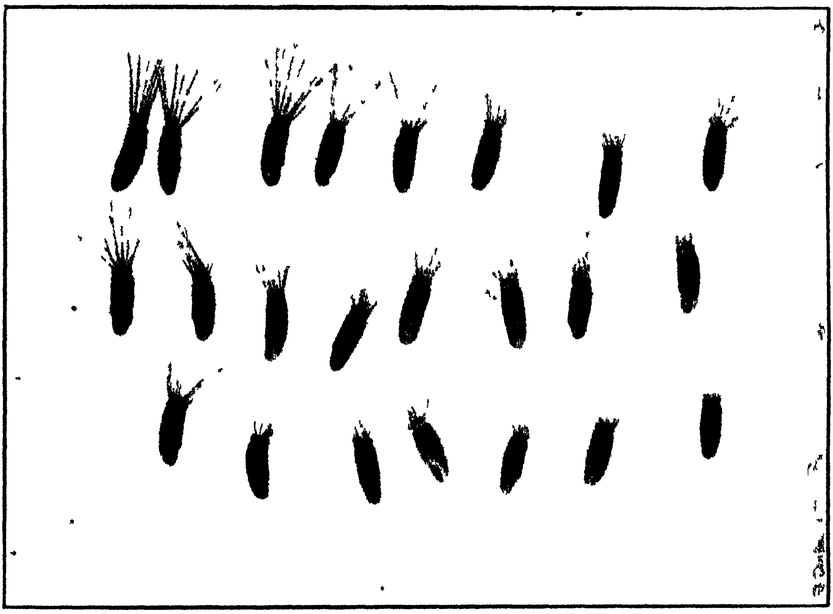


PLATE I

[Photo by H. King

Achenes of the Blessed Thistle (*Carbenia benedictus*).

planting (Plate II, Fig. 4) The cotyledons are green in colour, about ¼ inch long, spathulate, smooth (Plate II, Fig 4); the plumule appeared one day later, and the first leaves were produced four days later. The latter was oblong, spiny, with a rough surface (Plate II, Fig. 5). These seedlings were planted out and grew rapidly The more advanced plants produced flowers during September, and set seed in December to January.

The plant is an annual, and grows to a height of 15 to 30 inches. At first the root is crowned with a large rosette of leaves, which vary from 1 to 6 inches in length: these are grey-green in colour, irregularly toothed along the margin, and with the oldest leaves of the rosette lobed. From this rosette of leaves the main-stem arises and is stout, erect, much branched, softly woolly, light green in colour, striate, the striations being a light reddish colour. The stem leaves

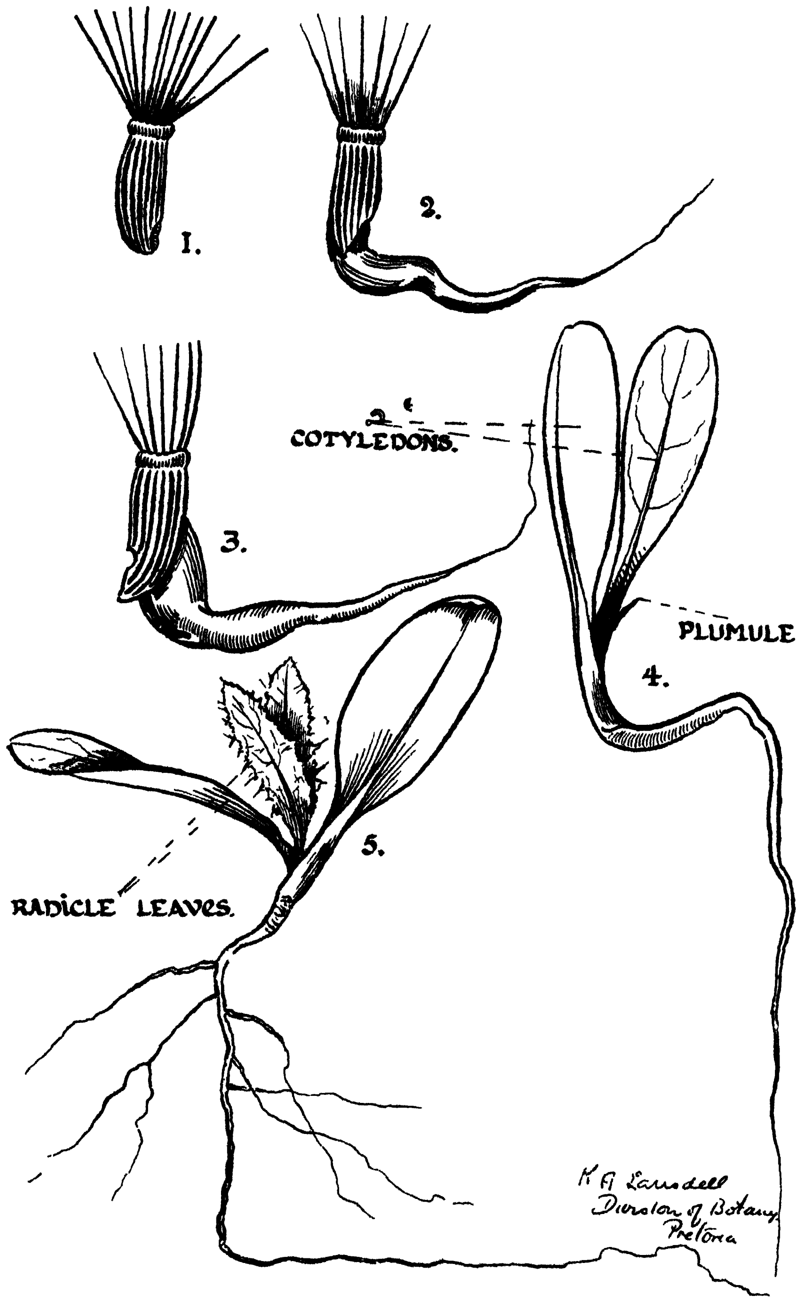


PLATE II.

Fig. 1. -Achene. Fig. 2.—Germination. Fig. 3.—Germination.
Fig. 4.—Seedling 17 days old. Fig. 5.—Seedling 2–3 weeks old.
(All enlarged.)

(*Carbenia benedictus.*)

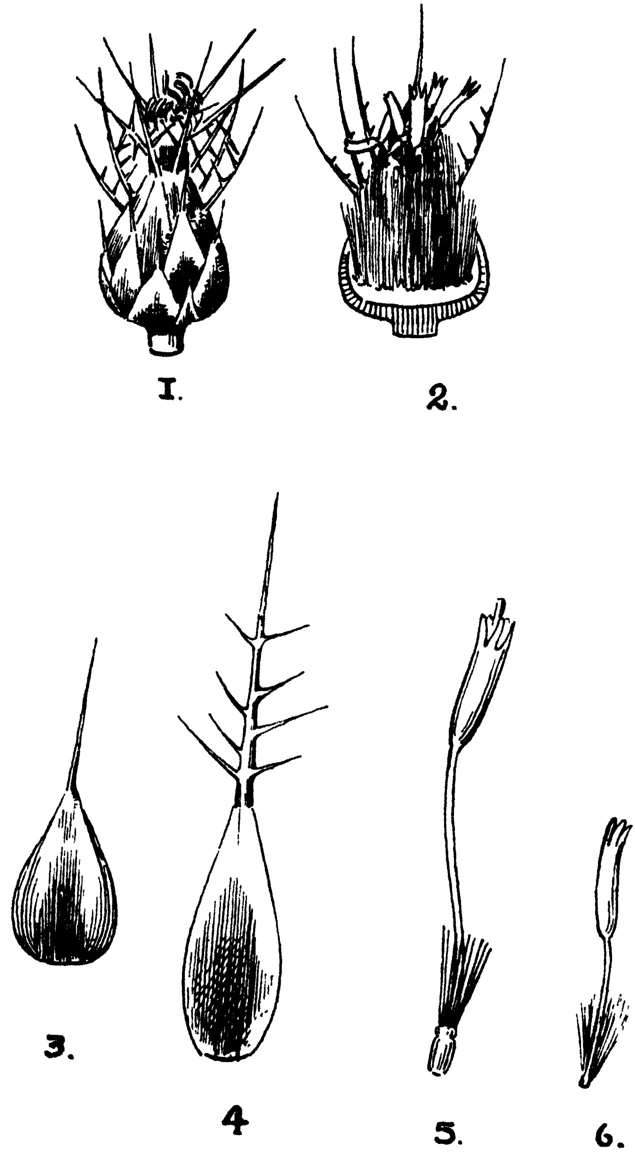


PLATE III.

Fig. 1.—Head (natural size). Fig. 2.—Longitudinal section of head showing receptacle Luios.
Fig. 3.—Outer scale (enlarged).
Fig. 4.—Inner scale „
Fig. 5.—Fertile floret „
Fig. 6.—Sterile floret „
(*Carbenia benedictus.*)

PLATE IV.
Portion of Plant.

are alternate, bright green in colour on both surfaces, 3 to 6 inches long, lance-shaped in outline, but deeply cut and lobed, with the margins toothed and spiny, thin in texture, net-veined, with a prominent mid-rib on the underside; the lower leaves narrowing to margined petioles; the upper leaves are sessile and clasp the stem. As the leaves mature they become hard and pungent.

The flower heads are large and solitary at the ends of the branches and closely surrounded by the upper leaves. (Plate IV.) The involucre is ovoid, with imbricated bracts in several rows; the outer bracts are ovate and leathery, spine-tipped; the inner bracts lance-shaped and tipped with long pinnately branched reddish-yellow spines, longer than those of the outer row (Plate III, Figs 3 and 4).

The "flowers" are deep yellow in colour; the florets all tubular; the marginal florets in one row and sterile; the central florets perfect and fertile. The receptacle is covered with long white silky hairs. (Plate III, Figs. 1, 2, 5, and 6.)

Eradication.—Prevent seed production. Cultivation of the ground at once destroys these plants.

The "Blessed Thistle" is not a proclaimed weed in South Africa (at date of publication).

Summary of information for use in the recognition of the weed, dissemination, and eradication:—

Vernacular name	...	The Blessed Thistle.
Scientific name	...	*Carbenia Benedictus*, L.
Duration ...	...	Annual.
Flowerhead	...	Thistle-like. Yellow in colour.
Leaf... ...	...	Spiny, ridged, net-veined.
Seed ...	...	Large, black, with stiff bristles.
Habitat ...	...	Roadsides, pasture lands, water-courses.
Dissemination	...	Wind, fodder, flood-waters.
Eradication	...	Never allow the plant to set seed.

CITRUS CANKER ERADICATION.

INSPECTION WORK, JANUARY, 1926.

Farms Inspected—

Rustenburg District (Hex River Ward).—Buffelspoort No. 668, Grootfontein No. 606, Elandskraal No. 321, Bokfontein No. 647, Kafferskraal No. 915, Roodekopjes No. 171, Elands Drift No. 284, Buffelshoek No. 900, Droogfontein.

Pretoria District (Crocodile River Ward).—De Kroon No. 420, Greylingspost No. 111, Wildebeesthoek No. 120.

Pretoria District (Aapies River Ward).—Klipdrift No. 8.

Fresh Infections found on the following farms previously reported infected—

Government Experimental Orchard, Buffelspoort No. 668, District Rustenburg, 4.

Fresh Outbreaks.—Nil.

Total Number of Nursery Stock Inspected.—5,500.

Total Number of Trees Inspected.—8,285.

Total Number of Trees found Infected.—4.

Total Number of Inspectors Engaged.—14.

PAPERS EMPLOYED FOR WRAPPING FRUIT.*

BY FRANCOIS J. DE VILLIERS, B.A., M.Sc., Ph.D., Research Physiologist in Horticulture, Elsenburg School of Agriculture.

IN examining boxes of fruit packed for export the writer has noticed that very poor papers, or papers that may have a deleterious effect on the fruit, are frequently employed by exporters. The indiscriminate use of widely varying types of paper is in most cases due to the fact that the choice of paper is purely arbitrary, or is that of the most convincing fruit agent.

Unfortunately, fruit wrappers have as yet received practically no scientific investigation, and hence no standardization of such material exists at the present time. It was thought, therefore, that by giving this matter careful attention, and by determining what are the primary factors which contribute towards a first-class wrapping paper, the fruit-grower would be supplied with some simple criteria for choosing his wrapping material in the future, and, further, he would be in a position to demand from the paper manufacturer a fruit wrapper which adequately conforms to his particular requirements.

Micro-chemical tests have shown that the fruit wrappers are generally composed of cellulose fibres; further, that these fibres are characteristic of spruce wood and have an average measurement of 1.5 millimeters. The original fibres, however, undergo varying types of treatment, with the result that widely different papers are produced.

A good fruit wrapper should be thin, strong, porous, readily pliable, and resistant to deteriorating agencies. Fortunately there are several samples of paper on the market to-day which meet all the requirements of such an ideal paper.

It is entirely unnecessary to utilize a heavy, strong paper. In fact such papers are generally stiff, and special effort has to be made by the packer to do his job, while the extra force applied in the process of wrapping often causes injury to the fruit, especially where such products as grapes are being treated.

In general the tensile strength was in most cases found to be satisfactory. Several paper samples measuring 2 by 5 inches—and often only one ten-thousandth inch in thickness—required a " pull " of 7 to 8 pounds to cause rupture. This value adequately meets the strain to which fruit wrappers are generally subjected in the process of packing. Unfortunately, papers having lower strength values are still being used by many growers.

Papers stored for a time in a very dry atmosphere have a tendency to become brittle, whereas if there is again an excess of moisture in the air, the cellulose fibres absorb moisture, and the

* A brief summary of a paper by Dr. De Villiers, entitled " Physical and Chemical Analyses of Papers employed for Fruit Wrapping," now in the hands of the printer for publication in due course as Science Bulletin No. 47.—EDITOR.

tensile strength of the paper becomes markedly lowered in consequence. It is, therefore, advisable not to have too much of a surplus of fruit wrappers on hand, unless adequate storage facilities are available.

In the original treatise special emphasis was laid on the fact that, if either moisture, carbon dioxide, or the esters exhaled by the fruit are allowed to accumulate around it, deterioration of some kind or other—growth of rot organisms, abnormal metabolism, etc.—is sure to follow. It therefore becomes absolutely essential to use a highly porous paper which will allow the rapid passage of the above-named products. Even porous papers will retard normal transpiration—the loss of moisture from the fruit—to the extent of 50 per cent.

In our investigations we came across some highly non-porous papers. In fact in some cases no passage of air whatsoever could be made to take place through the paper, not even under pressure. Such impermeable papers should be strictly avoided.

Deterioration of fruit wrappers, especially those composed of inferior fibres and containing impurities, have been found to take place as the result of exposing them to sunlight, desiccated (drying) or highly moist atmospheres, and high temperatures. Since those papers used for wrapping fruit do not as a rule contain gelatines or starch, substances commonly used as sizing materials, they have not been found to favour or support the growth of ordinary fungi.

"Greased" papers are sometimes recommended for wrapping fruit which develop scald and other skin diseases in cold storage. These papers contain a specific absorbent for the esters exhaled by the fruit thus treated. The accumulation of these esters are said to cause the physiological breakdown of the epidermal (skin) and subepidermal cell layers. In connexion with the use of different greased papers further research is necessary before definite recommendations can be made.

Finally, it is suggested that when the farmer is in doubt as regards the suitability of any particular paper for wrapping fruit, he should send a sample to the Department's Division of Horticulture for examination.

Nurseries in Quarantine at the 1st February, 1926.

Name.	Address.	Cause of Quarantine.	Extent of Quarantine.
Distributors Co., Craighall Nursery	Craighall, Johannesburg	Crown-gall ...	Deciduous, all.
D. J. Conradie & Bros.	Robertson, C.P. ...	Red Scale ...	Citrus, all.
A. S. Strydom & Co. ...	Krakeel River ...	Woolly Aphis ...	Deciduous, part.
G. J. Labuschagne ...	Groot Marico ...	Red Scale ...	Citrus, all.
Distributors Co., Johannesburg	Craighall, Johannesburg	Pernicious Scale...	Deciduous, part.
C. A. Geerdts	Lydenburg ...	Pernicious Scale...	Deciduous, all.
Chas. Ayres	Rondebosch, C.P.	Red Scale ...	Ornamentals, part.
C. Stuber	Mowbray, C.P. ...	Circular Purple Scale	Palms, all.
Flynn, W.	Somerset West ...	Woolly Aphis ...	Apples, all.

PRINCIPAL AGRICULTURAL ACTS OF THE UNION.

VIII.

Fertilizers, Farm Foods, Seeds, and Pest Remedies Act, No. 21 of 1917.

THE purpose of the Act is to regulate the sale of fertilizers, farm foods, seeds, and pest remedies, so as to protect intending purchasers from buying inferior or unsuitable articles.

Definitions.—"Fertilizer" means any substance containing nitrogen, phosphoric oxide, potash, or lime for the purpose of fertilizing the soil; farmyard or stable manure, kraal manure, kraal manure ash, town refuse, or night soil are not concerned.

"Farm foods" are all artificially prepared feeding stuffs, whether mixtures or otherwise, intended for feeding domestic animals and live stock; also sterilized bone-meal and all condimental stock foods claimed to possess nutritive as well as medicinal properties; dog biscuits and dog food, or poultry food or hays and straws, or whole seeds of grains, which are not mixed with other substances, are not concerned.

"Seeds" means such seeds as may be declared by notice in the *Gazette*.

"Pest remedy" is a substance for the prevention or destruction of any noxious plant or insect or any parasitic pest of plants or animals.

Protection of Purchasers.—No person shall supply any fertilizer, farm food, seed, or pest remedy which is not of the nature, composition, or quality as described when sold to the purchaser.

Guarantee.—The seller of any fertilizer (in quantities of more than 100 lb. in weight) must give the buyer at the time of delivery an invoice showing the quantity sold, the registered name or brand, and the chemical constituents (nitrogen, phosphoric oxide, potash, lime, as the case may be). This statement will be a guarantee that the article is as described.

An invoice of the same nature must likewise be furnished in the sale of any farm food. Registration is not necessary, however, and the procedure is simpler generally in respect of unmixed meals, brewers' grains, malts, sprouts; also wheat, rye, maize, and buckwheat brans, or middlings, etc., as described in Section 11 of the Act.

Labelling of Seeds.—No one may sell any seeds which are not accompanied by a label giving the name of the seeds, and this label will be a guarantee that the seeds are not below the standard of purity and germinating capacity prescribed by regulation. Seeds below this germinating capacity, however, may be sold provided the label shows the guaranteed germinating capacity thereof.

Sterilization of Bones.—All bones manufactured into fertilizers must first be completely sterilized.

Inspection at Ports.—Fertilizers, etc., imported may be detained at any port for purposes of analysis or examination. If deemed necessary, samples thereof may be taken, and if not meeting the requirements of the Act the goods may be disposed of as the Department of Agriculture may direct, or, at the option of the importer, be re-exported.

Locally Grown Seed.—The Act does not apply to the sale of seed grown and sold and delivered by any bona fide farmer on his own premises for seeding by the purchaser, but the farmer will not be exempt from prosecution if he sells killed or dyed seeds. The Act applies, however, if the purchaser obtains from the farmer at the time of sale a certificate that the seed is supplied subject to the provisions of the Act.

Analysis.—The Governor-General may appoint officers as analysts and seed testers under the Act. The Department of Agriculture may empower any officer in the Public Service to enter premises where fertilizers, farm foods, seeds, or pest remedies are kept for sale, who may purchase samples of such fertilizers, etc. The sample must be taken in the presence of the seller and a credible witness, and there divided into three parts, each of which must be sealed and marked. One part will be taken for analysis or testing, one kept by the seller (who will be notified of the purpose thereof), and the third kept by the officer for future comparison. The one part will be analysed or tested by the duly appointed analyst or seed tester, and the result thereof will be stated in a certificate. If the owner refuses to sell a sample, such sample may be taken and then be subject to the same procedure as one purchased.

In any proceedings arising out of the Act the certificate respecting the above-mentioned analysis or testing will be sufficient evidence of the facts stated in the certificate, unless the accused requires that the analyst or seed tester be called as a witness and that the parts of the sample retained respectively by the analyst or seed tester and the purchaser be produced; otherwise the accused is entitled to put interrogatories to the analyst or seed tester, which, with the answers thereto, will be accepted as evidence.

Prosecutions.—Prosecutions must be instituted within six months of the contravention, and the Act lays down certain other requirements regarding the furnishing of the analyst's or tester's certificate. In any prosecution it is not necessary to prove an intent to defraud. Special defences are also set out in the Act, such as samples on which prosecution is instituted not being in accord with an average of a number of samples of the same brand, goods sold in same state as received under a registered guarantee from the manufacturer, etc.

Forging a certificate or brand (i.e. the impression of any letter, number, geometrical figure, mark, sign, or character or combination thereof, upon any bag, barrel, package, or parcel, containing any particular kind of fertilizer, farm food, seeds, or pest remedy) is an offence. Wilfully applying any certificate to goods to which such certificate does not apply is also an offence, as well as giving a warrant or invoice or label in writing to any purchaser which falsely describes the article sold.

Special provision is made for penalties, costs, etc., arising out of specific irregularities mentioned in the Act.

Publication of Returns.—A return will be published each year in the *Gazette* showing the names of the manufacturers, importers, and dealers in fertilizers, farm foods, and pest remedies which have been registered under the Act. The return will show also the brand and the chemical constituents in each instance.

Regulations.—The Governor-General may make regulations generally for the better carrying out of the objects and purposes of the Act, and specially in respect of the marking, labelling, or branding of goods; registration, certificates of registration, etc.; the furnishing of guarantees; the limits of deficiency of necessary ingredients; the manipulation of fertilizers, etc.; the importation of fertilizers, etc., liable to convey contagion or containing injurious substances; the prevention of the sale of killed or dyed seeds; the analysis of fertilizers, etc., and the procedure and fees in connexion therewith; and the procedure to be adopted in the taking of samples on importation.

The regulations may prescribe penalties for any contravention thereof or default in complying therewith, but no such penalty may exceed ten pounds.

PRESENT REGULATIONS.

The following Government Notices have been issued under the Act, and contain regulations that are at present operating:—

1. No. 436 dated 25th March, 1919.

These regulations provide for registration, brands, sale of fertilizers and farm foods, taking of samples and analysis, certificates, constituents, etc. They (and also the chief features of the Act) are explained in detail in an article in the *Journal* of April, 1920, to which reference should be made.

Sections 16 and 21 of these regulations, however, were repealed and substituted by new sections issued under Government Notice No. 1968 of the 26th November, 1924, in respect of the sterilization of bone-meal and products derived from animal carcasses.

2. No. 507 dated 27th March, 1922.

These regulations control the sale of pest remedies (other than registered stock dips), and set out, among other provisions, the manner of labelling containers and the required composition of specific ingredients.

3. No. 1375 of the 15th August, 1923.

These regulations concern the sale of stock dips, and are published, together with full explanatory details, in the *Journal* for March, 1925.

(NOTE.—Government Notice No. 215 of 6th February, 1924, issued under the Diseases of Stock Act, 1911, provides for the colour to be given to arsenite of soda and all stock dips containing arsenic.)

4. No. 2130 dated 23rd December, 1924.

These regulations govern the registration, labelling of receptacles, and sale generally of stock remedies, i.e. any pest remedy sold or intended or offered for sale for internal administration in the destruction of parasites or prevention of parasitic infection of animals or in the cure or prevention of disease of animals.

THE CARNATION WORM.

By DAVID GUNN, Division of Entomology, Port Elizabeth.

FOR some time past the mischief done to carnations in gardens and carnation fields by the caterpillars of *Epichorista ionephela* has been the subject of observation by the various branches of the Division of Entomology. Severe damage has been reported from time to time in the Transvaal, and the records of the branch at Capetown state that at Rosebank, recently, a large percentage of potential cuttings were rendered valueless and many young plants ruined. There is also some evidence to show that the pest was mischievous in Natal ten years ago.

For five years past the insect has been a subject of complaint in the eastern Cape Province, notably at Port Elizabeth, Uitenhage, and Sundays River Valley. In November, 1924, fully 75 per cent. of the shoots forming in the carnation beds at a local florist's establishment were found infested, and advantage was taken of this opportunity to note the habits of the insect and formulate control measures.

LIFE-HISTORY AND HABITS (CAPE).

The life-history is briefly as follows: The eggs are laid together in numbers, both on the under and upper surfaces of leaves, and so arranged that they overlap like the scales of a fish. When first deposited the eggs are yellowish-green; but later the green hue disappears—within two days before hatching—and the dark-coloured head of the larva becomes visible. The incubation period is from nine to twelve days.

When the larva emerges it is exceedingly active, and feeds upon the upper surface of leaves; but within three days it begins to burrow into a shoot. In many young plants the larvae have been seen to burrow through the nodes of the stem, but this is the exception,

* *Epichorista ionephela*, Meyr., has come to be regarded as a South African species, but it is interesting to note that the late Dr. L. Peringuey seems to have always held the idea that it was introduced from abroad.

Professor A. J. T. Janse gives the known distribution of the species as follows :—

Transvaal: Pretoria District, Haenertsburg. Bronkhorstspruit, Barberton, Waterval Onder, Pilgrims Rest.

Natal: Colenso, New Hanover, Karkloof, Giants Castle. Rietvlei, Shafton Grange, Sarnia.

Zululand: Eshowe.

Cape Province: Capetown, Elsenburg, Port Elizabeth, Uitenhage, Sundays River Valley.

The species was first described by Meyrick (Annals, South African Museum, Vol. 5, p. 350, 1909) as *Proselana ionephela*, and in the same year transferred by him to *Epichorista*. Meyrick's original note on this insect is not without interest. It reads: "This is a very interesting occurrence, the genus *Proselana* being hitherto known only from Australia and New Zealand, especially the latter; to some of the New Zealand species the present one is very similar."

not the general rule. They also have a habit of binding several leaves together with silken threads and so affording themselves protection from the heat of the sun and enemies. In badly infested gardens so many shoots and buds may be injured that no flowers form.

The length of the larval stage varies with climatic conditions. In hot weather it may be completed within twenty-four days, whereas in cold weather it may be extended over forty days. When mature, the larva spins a cocoon, either at the top of its burrow in a stem or between leaves it has drawn together.

[*Photo by D. Gunn.*

Carnation buds injured by caterpillars of *Epichorista ionephela.*

CONTROL MEASURES.

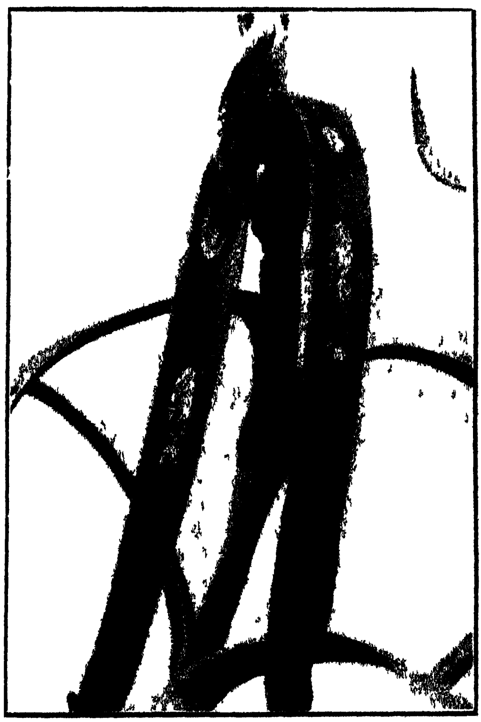
It is fully realized that when this insect becomes active toward the beginning of September or a little later, control measures should then be begun; but in the experimental control work at Port Elizabeth a beginning was not made until December, after a large number of plants had been injured.

The two insecticides used during the summer months were: (*a*) arsenate of lead powder, 1¼ pound to 40 gallons of water; and (*b*) tobacco extract, containing from 6 to 8 per cent. nicotine, at the strength of 1 gallon or 1 measure to 60 gallons or measures of water (with the addition of a pound of good yellow soap to every 20 gallons of spraying solution to make the mixture spread better.) Plants were sprayed with these two insecticides once each week. In the case of the arsenate of lead powder spray, the larvae were destroyed when they began to eat the leaves after emerging from the eggs, whilst the tobacco extract killed the larvae by contact, whenever it touched them.

It was found essential that both should be applied to the plants as a fine mist to obtain good results. An unsprayed plot was used as a check for comparative data, and after four months' experimental work, it was found that these two sprays had reduced the number of larvae on the plants to such an extent that their destructive work was rendered negligible.

Dusting the infested plants with a mixture of paris green and lime was also undertaken, but on account of windy weather no definite results were obtained.

The above recommendations should not be regarded as final, as it is possible that after further experimental work has been undertaken, more effective means of control may be devised.



[*Photo by D. Gunn.*

Egg clusters of *Epichorista ionephela* upon the upper surfaces of carnation leaves.

MAIZE SHOW STANDARDS AND THEIR RELATION TO YIELD.*

By A. R. SAUNDERS, M.Sc. Agric., Plant Breeder, School of Agriculture, Potchefstroom.

THE question of show standards for maize is not an easy one to consider and the solution to many of the problems connected with it must be left to time and to the beneficence of Nature. Some will doubtless think that the views expressed in this paper are rather too radical and revolutionary; but they are given in the best interests of South African maize growers, and are the only ones that I am at liberty to express if I wish to have any regard to the scientific truth as far as we know it.

I am one of those who believe that our maize shows have, in various ways, rendered a high quality of service to the community. The educational value of agricultural shows in general is a matter of common knowledge and belief, and it seems reasonable to contend that our maize shows have been a valuable means of extending information as to superior varieties and of fostering interest in better methods of agricultural practice as regards maize production. The shows have also served to encourage some methods of selection and to advertise selected seed through which the general uniformity of the crop and the purity of varieties with certain marked characteristics have been maintained.

The competitive exhibition of plants and plant products is not anything new in agricultural history, and maize shows probably date back to the latter part of the last century. Artificial standards of perfection have been introduced and our systems of judging have consisted essentially in comparing the show samples on the basis of their approximation to the so-called "Ideal." The exhibition of maize on points of external appearances has been thought both natural and commendable, and superficially the maize score-card is really quite plausible. It is a known fact that the largest possible yield of maize is obtainable from an ear which is large, cylindrical in shape with great depth of grain, minimum space between the rows, and maximum filling of butts and tips. It is, therefore, seemingly reasonable to rate samples of maize according to the measure in which they embody these features and to encourage selection on this basis.

THE EXPERIENCE OF SELECTION.

Have any important results been obtained from such a method of selection? This is a question which has occupied the minds of scientific men and many practical farmers for a considerable length of time.

* Paper read to the South African Maize Growers', Breeders', and Judges' Association at their annual meeting, held at Johannesburg, 2nd September, 1925.

Some twenty years ago experiments were started to inquire into the relation between ear characters and acre yield. Let us examine critically some of the evidence obtained from these experiments. Montgomery in 1910 and 1915 reported a yield of 4.4 bushels per acre as an average for four years in favour of rather long, smooth type of ears of Reid's Yellow Dent as compared with the standard type of that variety. Williams and Welton in 1909 reported the results of an exhaustive test of the relation of score-card characters to yield. As an average for ten years they found a difference of 1.39 bushel in favour of long ears as compared with short ones, but this difference was regarded by the authors themselves as being "no greater than what might have been expected had the seed used been identical." Cylindrical ears were likewise compared with tapering ones, and a difference of 1.65 bushel, as an average for nine years, was obtained in favour of the latter. An eight-year average showed practically no difference between the yields from bare tips and filled tips. Smooth and heavy ears yielded slightly more than rough and light ears respectively, and the yields from ears of high and low shelling percentage were practically alike. Ears with 14, 16, and 18 rows gave differences well within the limits of experimental error.

Pearl and Surface in 1910 presented data from their own extensive experiments as well as a large number of other data bearing on this problem. The results can best be summarized in the author's own words: "The large, well-tipped, beautifully shaped ear is just as likely as not to be a poor yielder when planted. This result means that the external visible characters are a very unreliable indication of its worth for seed purposes."

One of the most complete investigations of this kind was that reported by Ewing in 1910. He worked with a number of characters and concluded *inter alia*: "In the case of none of the characters studied has the coefficient of correlation with yield been found sufficiently great to be of much value as an index to selection. No single character has shown itself so closely connected with yield of grain as to stand out as a safe guide to the breeder."

Cunningham in 1915 brought forward additional evidence furnished by extensive experiments in which several varieties were used. Long, medium, and short ears gave practically equal yields. A slight advantage in favour of small as compared with large circumference was noted; well-filled tips and well-rounded butts showed no advantage. Smooth ears out-yielded rough ones in all the varieties, but medium rough ears led both other types in the majority of varieties. There was no relation between shelling percentage and yield, and usually a negative one between number of rows and yield.

Love in 1917 reported on correlation studies involving several ear characters and yield. In sum, his work indicates that the characters, length, ratio of tip, circumference to butt circumference, average circumference of cob, weight, average weight of kernels, number of rows, and average length and width of kernels on the seed ears do not show correlations significant enough to be of value in judging seed maize. The author believes that "the judge at a maize show or farmer selecting his seed maize cannot pick the high yielding seed ears when judging from outward appearances." In other words the points

emphasized on a score-card are of no value for seed-ear purposes, and are entirely for show purposes.

Suppose we turn to more recent evidence. Kiesselbach in 1922 produced results which indicated that, within reasonable limits at least, variations in ear characters were rather neutral in their effect upon yield, except when they were definitely linked with special adaptive growth characteristics of the plant. For example, slender ears with smooth, shallow kernels tended to be produced on earlier maturing, smaller, and less rank growing plants than were large, rough, deep-kerneled ears of the same variety.

A few months ago Richey reported on the results obtained from extensive investigations carried out by the United States Department of Agriculture. In his own words: "It seems reasonable to conclude that attempting to judge the relative productiveness of samples of reasonably good ears on the basis of their appearance is not warranted."

What then is the significance of these results and in how far should we take cognizance of them, if at all, in regard to our maize show standards? Are these data not somewhat unintelligible? If a certain type of ear bears the maximum weight of grain, should not selection of such ears increase production according to the evolutionary teaching that like begets like? The case is paradoxical to be sure, but in appearance only, and there are several explanations.

HEREDITARY INFLUENCES.

Maize is a normally cross-fertilized crop. Each kernel results from a separate sexual union and theoretically there may be as many different male parent plants (each with its own hereditary potentiality) concerned in the production of an ear of maize as there are grains on that ear. The influence of the male parent is just as great on the offspring as that of the female parent, and—here lies the point—the superficial examination of an ear of maize furnishes no clue to the hereditary excellence or otherwise of the numerous male parents concerned. Is it justifiable to contend that a good cow will produce superior calves even though mated to scrub sires? The force of this analogy makes clear the point under discussion. Again, when ear selection is practised without any reference to the character of the plant itself, as generally happens, knowledge even of the female is at best imperfect. Nevertheless these facts are not in themselves sufficient to explain failure when selection is continued for some time, for the relative proportion of show-type ears should increase from year to year as a result of continued selection.

The final explanation is based on a fundamental principle of genetics or heredity in maize. Selection according to an ideal type results ultimately in greater uniformity; a high degree of uniformity means greater hereditary sameness, and hereditary sameness implies close relationship or inbreeding. Now the average maize plant owes its normal vigour to the fact of its being the outcome of a cross between relatively unrelated individuals, and as soon as inbreeding is practised a reduction in yield is invariably the consequence. This diminution in productivity is slow under ordinary farming conditions, but sufficiently great to be the cause of considerable losses over a period of years.

MAIZE SHOW LESSONS.

In this regard there is a suspicion in the minds of many investigators that the good derived from our maize shows has not been entirely unmixed with harm. The evil may not be attributable directly to the shows themselves, but to the mistaken line of reasoning that certain external characters of maize are synonymous with high acre production. Furthermore, because of this arbitrary doctrine, and because of the high premiums frequently awarded to small samples of fancy ears, growers have been encouraged to select rigidly according to a stipulated ear type or to buy prize-winning ears, and thus propagate from a comparatively narrow line of ancestry. Either practice introduces the factor of inbreeding with its harmful effects. The most glaring examples are those in which single ears are sometimes bought with the idea of propagating new and superior varieties. I do not believe any results from such practice have as yet been outstanding enough to warrant the wholesale adoption of the method. For the farmer to pay a high price for a single ear of maize is waste of good money, and the attempt at propagating a variety from it is enthusiasm misdirected and energy misapplied.

There are still other reasons why we should indulge in a little retrospection as regards our maize show standards and especially our systems of judging. In the first place these standards seldom take any cognizance of the change in type as brought about by adaptation through natural selection due to environment. Local adaptation has become recognized as one of the most important factors in profitable maize production. Observations in South Africa (and this is supported by an enormous body of evidence from abroad) indicate that in the areas of comparatively low rainfall any one variety tends to evolve into a smooth, shallow-grained sort, with fewer rows, smaller circumference, and earlier maturity if left to the effects of the natural environment. Over a period of years such maize becomes adjusted to its environmental conditions and superior in yielding ability under those conditions.

The chances of such maize taking a prize at the show are, however, not very favourable as a rule. Furthermore, where the standards are rigidly laid down and require the farmer to select the long, deep, and broad grained ears with large circumference, they cause him to work against adaptation in his methods of selecting and growing maize too large and late for his conditions.

Authoritative opinion has it, for instance, that Potchefstroom Pearl was at one time much earlier than it now is. It appears that through an erroneous policy of selecting with a view to satisfying show standards, the time of maturity of this variety has been gradually increased and its usefulness over a large portion of our maize-growing area greatly impaired. This is but a single case—there are probably many others of the same nature.

Prize-winning maize as judged on present standards, when grown under the favourable conditions of Natal, the low country, or Rhodesia, is not infrequently obtained for seed purposes by farmers in areas in which such maize is least adapted. This is quite often a direct effect of the show and is admittedly difficult to avoid. It can be avoided to some extent, however, by a further division of our prize lists into sections representing the areas of more or less similar

climatic conditions. The extent or strictness of such division is a delicate question, but a separation into low veld and high veld classes for most of our dent varieties is an obvious necessity.

THE IMPORTANCE OF THE UTILITY CLASS.

A class of maize deserving greater recognition is the Utility Class. In fact, it is no exaggeration to say that this class is the most important one on our show, although the two lone entries this year convey a different impression. The Utility Class is the one which received the largest measure of moral support from the Department of Agriculture, and it is the one which deserves the most liberal patronage on the part of farmers and seed producers. Samples entered in this class are judged not only on external appearance and trueness to type, but due regard is also had to factors of vital importance, such as freedom from disease and ability to germinate.

Instead of eliminating this class we should rather extend it to include separate classes for whites and yellows and in addition a grand championship. Exhibition in the Utility Class can be simplified by all the maize being forwarded to the S.A. Maize Growers', Breeders', and Judges' Society's grounds, and samples of the shelled maize only then sent to Potchefstroom for testing. It is hoped that the time is not far off when the society will have its own testing facilities and that every large sample of maize exhibited on the Rand will bear a certificate stating its germination percentage and freedom from disease.

The view is frequently expressed that we have no trouble with the germination of our maize. Indeed, our relatively dry climate tends to exhibit the development of many maize diseases, but it needs only one wet year to reveal the presence of diseases which are spreading to an alarming extent, especially in the sections of high rainfall. As an example may be cited the *Diplodia* disease or "Dry-rot" of maize. I have seen a field of maize this year in one of our best maize-growing areas in which probably one-fourth of the crop had been destroyed by the disease. The remedy lies in the use of healthy seed and crop rotation.

FUTURE MAIZE SHOW STANDARDS.

The conclusion then seems justified that the slight differences in physical characteristics found among appreciably good ears of maize are of no value in determining their relative productiveness. This conclusion can be applied almost without exception to the results of individual studies, but when the data are regarded as a whole there appears to be certain definite trends as regards certain features. As Richey states it: "A majority of the comparisons are in favour of the heavier, longer, fewer rowed ears, and those with the lower shelling percentage or smoother indentation."

It is noteworthy that these are not the type of ear demanded by our show standards. They are, however, the type that nature seems to favour most, and it is, therefore, only logical to reason that in so far as the maize show has been effective in increasing the proportion of show maize used for seed, it may actually have

exercised a harmful influence. Such a statement receives additional support from experimental evidence on the effects of inbreeding.

Let these views be branded as purely iconoclastic, let me restate them clearly and definitely. The maize show should be continued by all means, but winning at this show should be taken for what it is, namely: evidence of good agricultural practice in maize production and ability and patience to select a good sample. The prize is really not won by the excellence of the maize—it is won by the diligence and skill of the exhibitor.

Finally, we recommend that our maize show standards and our methods of judging should acquire a more utilitarian stamp and should be so regulated as to encourage the development of maize varieties and strains which are thoroughly adapted to the conditions under which they are grown. The importance of adaptation warrants a stricter division into areas of more or less similar climatic conditions. To start with, there should at least be a separation into low veld and high veld for most of our dent varieties. There is no such thing as a universal best type, and what is often spoken of as " running out " of maize may be an actual betterment for prevailing conditions.

Farm Machinery.

In an article entitled " Agricultural Engineering at the Experiment Stations," by R. W. Trullinger in *Agricultural Engineering*, the journal of the American Society of Agricultural Engineers, October, 1925, it is indicated that the question of standardization of farm machinery is receiving some attention in the United States of America.

An outstanding line of investigation is that of the development and standardization of the different belt-driven and field farm-machines, other than tillage machinery, on the basis of the perfection of detail, as a preliminary to the perfection of entire machines to meet previously conceived, specific, agricultural requirements. This is indicated by studies made on silage cutters and blowers and other belt-driven machinery, such as threshing machinery, weed-destroying, grain-dusting, almond-harvesting, and seed-cleaning machinery, and also on milking machines.

Work is also being done at several experiment stations on the adaptation and standardization of tractor belt-pulley speeds to meet the operation requirements of belt-driven machinery.

A meeting of the Farm Power and Machinery Division of the American Society of Agricultural Engineers has just been held in Chicago. At this meeting a standards " round table " was held at which definite recommendations for standardization were presented by engineers from the farm equipment industry for discussion. Special committees were subsequently to be formed to consider the proposals and eventually formulate recommendations for definite standards for adoption by the society. (*School of Agriculture, Potchefstroom.*)

COTTON FERTILIZER TRIALS.

By THOS. D. HALL, Chemist, School of Agriculture and Experiment Station, Potchefstroom.

AT the request of the Turf Farmers' Association, the writer went to Naboomspruit on 1st May, 1924, to give a lecture on the "Status of Soil Fertility as regards Production." During the course of that visit he was taken to nearly every farm represented on the membership of that exceedingly live association. On Mosdene, the farm of Mr. E. E. Galpin, he was shown sundry strips of maize, each one acre in extent, running through the main field. On these strips the growth was not as good as that on the adjoining portions. These poor strips, the writer was informed, had been treated with basic slag and lime.

The benefits of phosphates on all crops have been so commonly noted all over the Union that this was an exceptional experience, and at once aroused the writer's interest. He had had instances of no benefits from phosphates, but never a depression of yield, although he had had experience of the depression of maize yields with agricultural lime. Mr. Galpin informed the writer that an analysis of the soil had been made, and that it was exceedingly low in total and available phosphoric oxide and just average in lime content. That afternoon on a very similar soil on another farm, the writer was shown the usual outstanding results obtained with superphosphate on maize, and he determined then to investigate this problem further. Generally speaking, in areas of low rainfall in the Transvaal basic slag has not proved so satisfactory a phosphatic fertilizer as superphosphate.

During May, at the request of the writer, Mr. Galpin supplied a ton and a half of the soil for pot-culture experiments during the winter in the greenhouse at Potchefstroom. If the writer could obtain a little more definite information on the action of various fertilizers, he would have a better basis for planning a field experiment in the spring.

DESCRIPTION AND COMPOSITION OF THE SOIL.

The soil was a red sandy loam taken from the farm Roodepoort No. 1974, Springbok Flats, Waterberg District. It was virgin soil nearest to the block of land where Messrs. E. E. and E. A. Galpin had carried out their trials. The analysis was done by the Division of Chemistry, Pretoria.

Physical Composition of Soil.

Stones ...	Nil.
Fine gravel ...	0·7 per cent.
Sand ...	49·0 „
Fine sand ...	27·2 „
Silt ...	23·1 „ by difference—not determined.
Fine silt ...	
Very fine silt ...	
Clay ...	
Moisture ...	

Chemical Composition of Soil.

Moisture ...	1·21	per cent.
Loss on ignition ...	3·00	„
Insoluble matter ...	88·35	„
Ferric oxide ...	2·76	„
Alumina ...	4·51	„
Lime ...	0·25	„
Magnesia ...	0·23	„
Potash ...	0·12	„
Phosphoric oxide ...	0·03	„
Nitrogen ...	0·07	„
Available potash ...	0·0133	„
Available phosphoric oxide	0·00)9	„

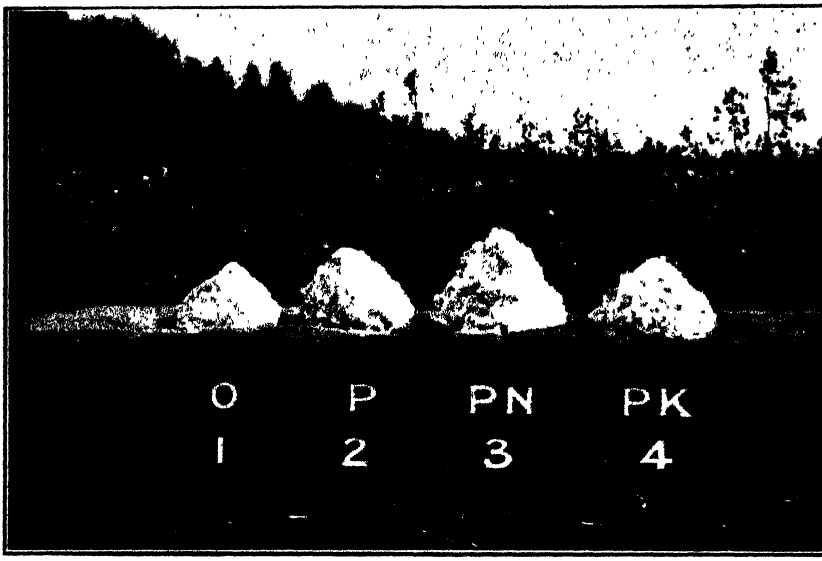


PLATE 1.

Plot No. 3 with superphosphate and sulphate of ammonia was outstanding in quality as well as in quantity. Super alone was quite good, and better than super with potash No. 4.

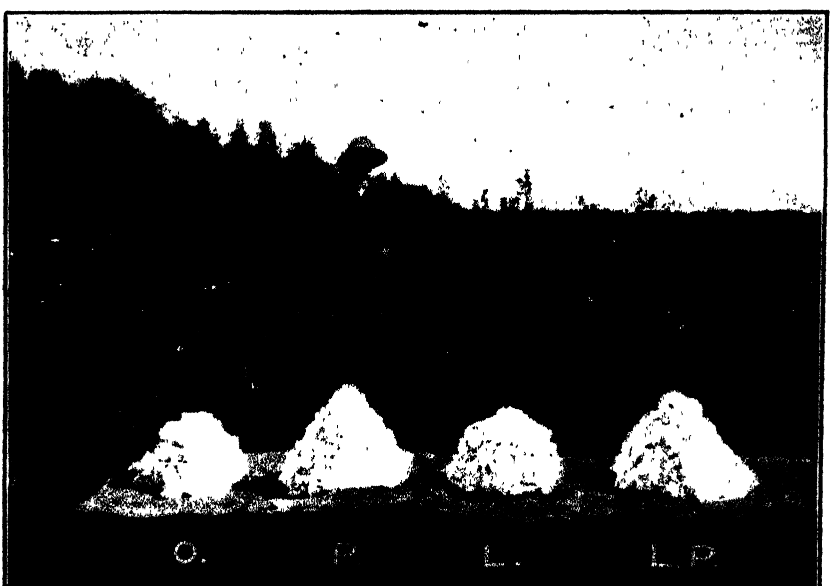


PLATE 2.

A comparison of super alone, with rock phosphate alone, and with a mixture of the two (L.P.). The super alone was best, and the mixture came next. Rock phosphates alone was not satisfactory.

The soil is very sandy, extremely low in organic matter, below the average in phosphoric oxide, and very low in available phosphoric oxide. In nitrogen content it is also below the average, but is about normal in potash and lime. Good returns from organic matter, phosphates, and perhaps nitrogen could be expected.

THE POT-CULTURE EXPERIMENT.

The details were planned by the writer and carried out by his assistant, Mr. J. V. Cutler. Thirty-two pots were used, in which green manure, superphosphate, superphosphate and Xmas Island rock phosphate, sulphate of ammonia, sulphate of potash, and coarsely ground limestone were tried in various combinations. The pots were planted to Smyrna barley on 16th June, after the various fertilizers had been mixed with the soil. The phosphates and limestone were applied at the rate of 300 lb. per acre, the sulphate of ammonia, 100 lb. per acre; the sulphate of potash, 75 lb. per acre, and the green manure (mung beans), 4 tons per acre. By 9th August, 1924, the cultures had shown clearly the following facts:—

(1) This soil's chief requirement is phosphates.

(2) Some nitrogen is also needed as there is a better colour and healthier growth wherever nitrogen is present.

(3) Potash is apparently not needed.

(4) Lime has some beneficial effect on barley in this soil. (It must be remembered that barley is a lime-loving crop, whereas maize is not.)

(5) The rock phosphate and super mixture in equal proportions gave about the same results as super alone.

(6) Green manuring apparently improved matters all round to some extent, and super and green manure were always better than super alone. This might be due chiefly to the nitrogen supplied in the green manure.

These results were just about what were expected from a soil of that composition. The soil has also a very poor water holding capacity and consequently a high water requirement.

THE CROP ROTATION AND FERTILIZER EXPERIMENT.

On the results of the pot-cultures a crop rotation and fertilizer experiment was planned and started in October, 1924, with the cooperation of Messrs. E. E. and E. A. Galpin. Mung beans, maize, peanuts, and cotton are the four crops represented in the rotation, each with a range of twenty-one one-fortieth-acre plots. Fertilizers are applied to the maize and cotton ranges only, and the peanuts and mung beans have the residues when the rotation brings them on to those ranges the following year. The mung beans are to be harvested for seed, and then ploughed under for green manure, if weather conditions permit. They have the advantage of being able to yield a crop of beans and still be sufficiently green and succulent for ploughing under. In the majority of fertilizer experiments with peanuts, when the fertilizer is applied to that crop, the writer has

had disappointing results, and for that reason they get only residues in this experiment. The rotation runs as follows: Maize after mung beans ploughed in; then cotton and peanuts.

THE FERTILIZER TREATMENTS.

On the eighty-four plots, which by next season will all have been fertilized once, superphosphate, two types of rock phosphate, Langebaan and Egyptian, alone and mixed with superphosphate, muriate of potash, and sulphate of ammonia will have been tried. The eastern halves of all the plots will be limed with agricultural lime at the rate of 500 lb. per acre. Details of this year's cotton range treatment will be found in Table II.

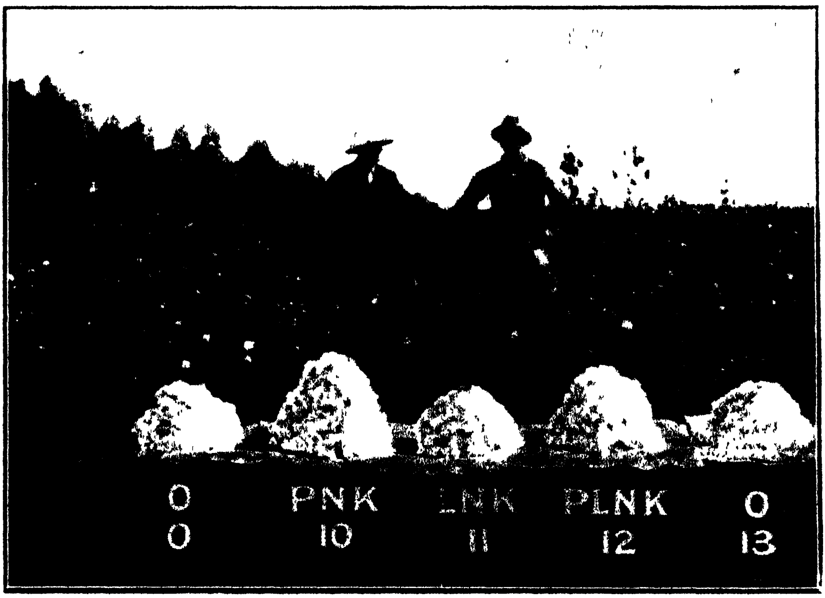


PLATE 3.

A comparison of complete mixtures. The mixture with super alone was slightly better than the complete mixture with super and rock phosphate. The rock phosphate mixture (L.N.K.) was no better than the controls O.

CULTURAL METHODS.

Mr. E. A. Galpin, who has kept the plots in fine condition throughout the year, has supplied most of the information given under this heading.

The land for the experiment was winter ploughed. The fertilizers were spread on the 17th and on the 31st October. The fertilizers were harrowed in. During the course of the season the land was cultivated three times and hand-weeded twice.

PEANUTS.

This crop was planted on 4th November, 1924. The rows were two feet apart, and the nuts nine inches apart in the rows. The

germination and the stand were poor. The nuts were pulled on 5th March, 1925, and picked on 20th March, 1925. The yield was only 365 lb. net off approximately one-half acre. The season was very unfavourable for nuts, as owing to incessant rain in March they could not be pulled and a large percentage commenced to sprout.

MAIZE.

This was planted on 25th November, 1925, in rows three and a half feet apart, and the plants were fifteen inches in a row. The crop was rather poor and patchy, and little difference was noticed between the various treatments. The plants began to fall over and suffer damage from ants during May. The stalks were thus cut and stooked in their respective plots, but whirlwinds blew them over several times and they had to be restooked. Finally, after a big wind, the stooks became so mixed that no differential yields could be taken. The plots as a whole yielded—

8¾ bags unshelled maize	1,131 lb. net.
5 bags shelled maize (203 lb. plus 77 lb.)	1,077 lb. net.

MUNG BEANS.

These were planted on 25th November, 1924, three and a half feet apart, and five inches in the row. The germination and stand were very good. The beans grew splendidly and reached two to two and one-half feet in height, and almost closed the rows. The beans were picked on 20th March, 1925, and thrashed on 1st April, 1925. The yield for the approximate half-acre was 534 lb. The ratio of seed to the picked seed and pods in bulk was 1 to 8. Owing to the mung beans developing blight, no further seed pickings were made. The bean vines were ploughed in during June, 1925.

COTTON.

This crop was planted on the 4th November, 1924, in rows four feet apart. The seed was Improved Bancroft. The stand was thinned down to nine inches in the row on the 2nd January, 1925. The growth and stand, though good, were not comparable with that of the main field of cotton planted on the 28th October, 1924. Distinct differences could be seen between the limed and unlimed halves and also between other treatments. Owing to the bolls not shedding, all the cotton was picked at one time on the 8th and 9th June, 1925.

Table No. I.

METEOROLOGICAL DATA FOR THE SEASON 1924–25.

Month.	Mean Maximum.	Mean Minimum.	Hottest Day.		Coldest Night.		Hours of Sunshine.	Total Clouds.	Rainfall.	
									Inches	No. of Days.
September	80·3	47·0	93·0	21st	26·0	2nd	302	56	0·64	3
October	84·6	55·4	92·8	15th	48·1	23rd	284	105	1·37	5
November	82·7	58·7	97·0	24th	49·2	9th	243	162	7·19	12
December	80·0	60·6	89·3	20th	55·9	13th	248	229	3·62	12
January	81·3	60·6	88·6	27th	52·9	19th	278	169	5·66	10
February	85·1	60·5	91·7	20th	55·5	6th	292	103	2·06	5
March	80·2	60·0	87·1	2nd	50·7	6th	139	139	3·27	16
April	76·5	53·8	82·7	19th	48·0	20th	184	164	2·04	7
May	71·7	42·1	77·7	3rd	31·1	22nd	253	98	0·51	4
June	71·0	34·2	80·0	3rd	25·2	6th	278	42	1·78	3

The rainfall for the year from 1st July was 28·26 inches. There was no rain in July and only 0·12 inch in August. Rain fell on 79 days during that period. From September to January the wind was fairly steady. The second half of January was very hot and dry, and February was also a hot, dry month. March was cool and cloudy and the peanuts suffered in this weather. April, too, was cooler and cloudier than usual.

Table No. II.

TREATMENT AND YIELD OF SEED COTTON PER PLOT IN LB.

No.	Treatment.	On One-eightieth Acre. Unlimed Half.	On One-eightieth Acre. Limed Half.	Total Yield for Fortieth-Acre Plot.
1	O.	5·50	4·25	9·75
2	P.	8·50	7·50	16·00
3	P.N.	10·50	10·75	21·25
4	P.K.	7·50	7·25	14·75
5	O.	7·00	7·25	14·25
6	L.	7·00	6·50	13·50
7	L.N.	7·50	7·25	14·75
8	L.K.	6·50	6·00	12·50
9	O.	5·00	5·00	10·00
10	P.N.K.	8·00	6·50	14·50
11	L.N.K.	4·75	4·75	9·50
12	P.L.N.K.	7·00	6·00	13·00
13	O.	4·75	3·25	8·00
14	P.L.	5·50	4·50	10·00
15	P.L.N.	5·75	6·00	11·75
16	P.L.K.	5·50	5·25	10·75
17	O.	4·00	3·50	7·50
18	P.	7·25	6·00	13·25
19	L.	4·75	4·25	9·00
20	P.L.	5·25	6·00	11·25
21	O.	4·00	4·50	8·50
	TOTALS ...	131·50	122·25	—

This means 9·25 lb. in favour of the unlimed half.

Key to Treatments.

O. ... ... No fertilizer.
P. ... ... 300 lb. per acre superphosphate.
L. ... ... 300 lb. per acre Langebaan rock phosphate.
P.L. ... 300 lb. per acre of mixture of equal parts super and Langebaan.
N. ... ... 100 lb. per acre sulphate of ammonia.
K. ... ... 100 lb. per acre chloride of Potash.

Carbonate of lime was applied to the eastern halves of all the plots at the rate of 500 lb. per acre.

Cost of Fertilizers at Naboomspruit.

Langebaan rock phosphate ... ... 4s. 6d. per 100 lb.
Superphosphate, 17.1 per cent. ... 5s. 6d. per 100 lb.
Sulphate of ammonia ... ... 20s. 9d. per 100 lb.
Muriate of potash ... ... 1s. 6d. per 100 lb.
Carbonate of lime ... ... 1s. 6d. per 100 lb.

PLATE 4.

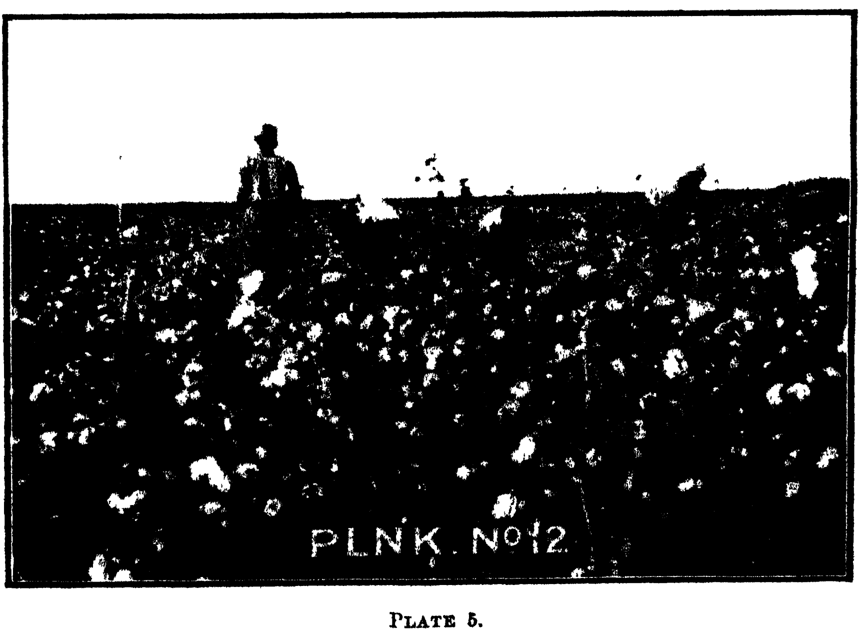


PLATE 5.

Two plots before picking: a control and a complete mixture with its phosphates in the form of a super-rock phosphate mixture in equal parts.

THE ACTION OF LIME ON THIS SOIL.

The difference in yield recorded in Table II works out at 35.2 lb. seed cotton per acre in favour of the unlimed half. This at 3½d. per lb. is worth 10s. 3d. Five hundred pounds of agricultural lime at Naboomspruit is worth 7s. 9d. It would seem then that liming actually caused a loss of 18s. per acre on this soil type. The loss in reality would have been more, because wherever the land was limed the cotton was distinctly harsher. Samples of seed cotton were submitted to Mr. L. Worrall of the Tobacco and Cotton Division. Every time he was handed a sample from a limed half he commented on its harshness.

Table No. III.

TOTAL YIELD PER ACRE OF ALL PLOTS, ALSO VALUES AND FERTILIZER COSTS.

No.	Treatment.	Lb. Seed Cotton.	Increase over Control Average.	Total Value at 3½d. per lb.	Cost of Fertilizer per Acre.	Increase over Fertilizer Cost.	Increase over Average Control Value of £5. 12s. 9d.
				£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	O.	390	-	5 13 9	—	—	0 1 0
2	P.	640	254	9 6 8	0 16 6	8 10 2	2 17 5
3	P.N.	850	464	12 7 11	1 17 3	10 10 8	4 17 11
4	P.K.	590	204	8 12 1	1 10 0	7 2 1	1 9 4
5	O.	570	—	8 6 3	- -	-	2 13 6
6	L.	540	154	7 17 6	0 13 6	7 4 0	1 11 3
7	L.N.	590	204	8 12 1	1 14 3	6 17 10	1 5 1
8	L.K.	500	114	7 5 10	1 7 0	6 18 10	1 6 1
9	O.	400	-	5 16 8	—	—	0 3 11
10	P.N.K.	580	194	8 9 2	2 10 9	5 18 5	0 5 8
11	L.N.K.	380	6	5 10 10	2 7 9	3 3 1	−2 9 8
12	P.L.N.K.	520	134	7 11 8	2 9 3	5 2 5	−0 10 4
13	O.	320	—	4 13 4	—	—	−0 19 5
14	P.L.	400	14	5 16 8	0 15 0	5 1 8	−0 11 1
15	P.L.N.	470	84	6 17 1	1 15 9	5 1 4	−0 11 5
16	P.L.K.	430	44	6 5 5	1 8 6	4 16 11	−0 15 10
17	O.	300	—	4 7 6	—	—	−1 5 3
18	P.	530	144	7 14 7	0 16 6	6 18 11	1 5 4
19	L.	360	26	5 5 0	0 13 6	4 11 6	−0 1 3
20	P.L.	450	64	6 11 3	0 15 0	5 16 3	0 3 6
21	O.	310	—	4 19 2	—	—	−0 13 7

For any increase of 96 lb. seed cotton per acre above the averages of the controls of 386 lb., there is a forty to one chance that the increase is due to the fertilizers, i.e. Plots Nos. 2, 3, 4, 6, 7, 8, 10, 12, and 18 show significant increases. The probable error is ±25 lb.

REMARKS ON THE QUALITY OF THE COTTON.

A number of small tobacco bags had been filled with samples by Mr. E. A. Galpin. These were given to Mr. L. Worrall of the Tobacco and Cotton Division, one at a time, and the treatment was not told him until his opinion of the sample had been recorded by

the writer in the presence of Mr. Mansvelt of the Tobacco and Cotton Division.

Plot No.	Treatment.	Remarks.
13	O.	Good length, excellent strength (sample mixed).
18	P.	Superior to No. 13 in length and strength; colour good.
19	L.Ca.	Short and harsh.
12	P.L.N.K.	Excellent length and strength, similar to No. 18.
10	P.K.Ca.	Not as good as No. 12. Shorter and a little harsh.
3	P.N.	Nice sample, good length, uniform, and certainly not harsh.
10	P.N K.	Very nice sample, excellent length and strength.
1	O.	Harsher, shorter, and more mixed than No. 10.
20	P.L.Ca.	Harsh and uneven.
13	O.Ca.	Uniform, good staple and strength.
4	P.K.	Not much different from previous sample No. 13, but a little more silky and a little better length.
9	O.	Harsher than No. 4, and shorter, but has good strength.
2	P.	Very nice sample, excellent length and strength.
10	P.N.K.	Very nice sample, shorter than No. 2 P., but quite silky and has good strength.
13	O.	Harsher and shorter than two previous samples.
11	L.N.K.	Very poor sample, short and harsh.
17	O.Ca.	Short and harsh.

Ca. indicates limed half of plot.

DISCUSSION OF THE RESULTS.

(1) On cotton, lime has given the same depressing defect that Messrs. E. E. and E. A. Galpin noted with maize on this soil type the previous season. No basic slag was tried in the experiment, and the other phosphates had no depressing effect; the super was, in fact, decidedly beneficial for improving quality as well as increasing quantity. The rock phosphate alone this first season affected the yield hardly at all. It was probably the lime in the basic slag which had the depressing effect, for even when lime was used in this experiment with superphosphate and rock phosphate, there was a distinct depression of yield and quality.

Lime in the Rustenburg experiments has given wonderful results; it must be borne in mind, however, that the soil on which those data were obtained contains only a trace of lime (2).

Hydrated lime at the rate of 400 lb. per acre was used in twenty experiments in Texas in 1913. The lime plots averaged 33 lb. per acre of seed cotton lower than the unlimed, a figure closely approximating that obtained in this experiment. In 1911 in Texas, 1,000 lb. carbonate of lime per acre gave a 51 lb. loss (1).

In general, lime has not figured very strongly in American cotton experiments or practice. Its value for the legume in the cotton rotation is, however, commented on favourably. In a symposium of cotton fertilizer results published by the United States Department of Agriculture, lime is credited with having given losses of 42 lb. per acre of lint and increases up to 127 lb. (3).

From data at present available in South Africa the writer is not prepared to recommend lime for cotton culture. There may be soils where it will pay well, but there will also be other soils where its use will be a distinct loss. Farmers should try an acre or two at the rate of 500 lb. per acre before investing in agricultural lime.

(2) Of the phosphates, superphosphate has consistently given the best results. If control plot No. 5 is considered abnormal, then plot No. 6 with rock phosphate alone has given a good return. In comparing plots Nos. 18, 19, and 20, it seems that a mixture of rock phosphate and super is much better than rock phosphate alone.

It must be remembered that the best effects of the rock phosphate are obtained only after several years of application. Here at Potchefstroom, with the bad quality iron and alumina Saldanha Bay phosphate, no results were obtained at all for several years, and now the returns are as good as from super and bone, used separately. Rock phosphate alone must be considered more as a cheap method of building up permanent fertility rather than a phosphate on which quick returns can be expected. In co-operative experiments carried out by the writer in conjunction with farmers, excellent results are being obtained by rock phosphate and super mixtures.

The Texas Station carried out sixteen experiments in 1912 comparing 200 lb. per acre of rock phosphate with 150 lb. superphosphate on cotton. The average results were slightly in favour of the super, 745 lb. seed cotton per acre as compared with 731 for the rock phosphate. In the United States summary of cotton experiments already referred to, rock phosphate did not give nearly such good returns as super, either alone or in various mixtures. None of the combinations, however, were with superphosphate. Alone its use was generally not profitable.

(3) Nitrogen combined with superphosphate has been very profitable and has given increased yields in other combinations, although not always profitable ones. There is a clear indication, however, of a shortage of nitrogen on this soil.

(4) As in the pot experiment, potash has not shown up or been profitable in any combination.

(5) The complete mixtures with phosphate, nitrogen, and potash have also been disappointing.

SUMMARY.

For this year's climatic conditions, and on the soil type herein described, the following conclusions can be drawn:—

(1) Phosphates are needed, and of those tried, superphosphate showed up best.
(2) Nitrogen is required, and 100 lb. per acre of ammonium sulphate gave increased yields when used with phosphates.
(3) Potash with phosphate, and with nitrogen and phosphate did not give increased yields, and in most cases worse yields than the phosphates alone.
(4) Lime not only depressed the yield, but also lowered the quality of the cotton.

RECOMMENDATIONS BASED ON THIS EXPERIMENT.

On the red sandy loam used in this experiment farmers are advised to try 150 lb. of superphosphates and 50 lb. of ammonium sulphate per acre for cotton. If the farmer has a legume in the rotation the ammonium sulphate should not be necessary. Instead of 150 lb. super, 100 lb. super and 50 lb. rock phosphate can be used. Instead of using ammonium sulphate the farmer can get some of

the nitrogen from bonemeal and use 75 lb. super, 75 lb. bone, and 25 lb. ammonium sulphate. Both dressings will cost approximately 18s. 3d. at Naboomspruit.

Some farmers may wish to use nitrate of soda in place of ammonium sulphate. To supply equal quantities of nitrogen, use 66 lb. and 33 lb. of nitrate of soda in the mixtures already given, in place of the ammonium sulphate.

AMERICAN EXPERIENCE IN FERTILIZING COTTON.

General.

Some of the conclusions from "Fertilizers for Cotton Soils" will be of more than passing interest, as that bulletin is a summary of 2,803 fertilizer tests on cotton, carried out during a period of twenty years through the whole of the American cotton belt.

(1) Fertilizers gave about the same increases on all classes of soil, fertile and poor. The increases ranged from 68 lb. to 155 lb. of lint per acre.

(2) Small quantities of fertilizer generally gave as large an increase as heavy dressings, and did so more profitably. (The amounts recommended by the Union Department of Agriculture are about right, 150 lb. to 250 lb. per acre of mineral fertilizers.)

(3) The ratio for increase to no increase was 4 to 1 for a single constituent fertilizer, 10.2 to 1 on a mixture of two constituents, and 154.5 to 1 for a mixture of three substances. The corresponding crop increases were 54, 82.5, and 169.4 lb. of lint per acre respectively.

(4) Varying amounts of farm manure alone, and farm manure mixed with superphosphates and potash comes first in increases and profits. The acre increases of lint ranged from 78 to 340 lb. The super in the mixtures ranges from 168 to 250 lb. per acre, the potash 10 to 85 lb., and the manure from 1 to 21 tons per acre. Of the three-mineral mixtures, the following amounts gave good gains per acre:—

Amount applied per Acre.		
Super	... 187 lb.	The three-mineral mixtures, came second in profits, but the profits were much smaller than in the manure mixtures.
Ammonium sulphate ...	... 109 ,,	
Chloride of potash ...	... 105 ,,	

Texas Experience.

This State in 1923 produced 4,290,000 bales of cotton, about four times as much as any other State, and about 850 times as much as our 1923 output. For this reason some of the fertilizer results from her experiments may be very helpful, and are certainly worth any cotton farmer's time in reading. Texas, too, approximates more closely to our climatic conditions than any other part of the American cotton belt.

The conclusions of Dr. G. S. Fraps, Chief of the Division of Chemistry, were made in the results of 151 co-operative fertilizer experiments, and have been summarized by the writer:—

(1) Superphosphate alone at the rate of 150 to 200 lb. per acre gave results in 74 per cent. of the experiments and increases from 50 to 185 lb. seed cotton. On the average it

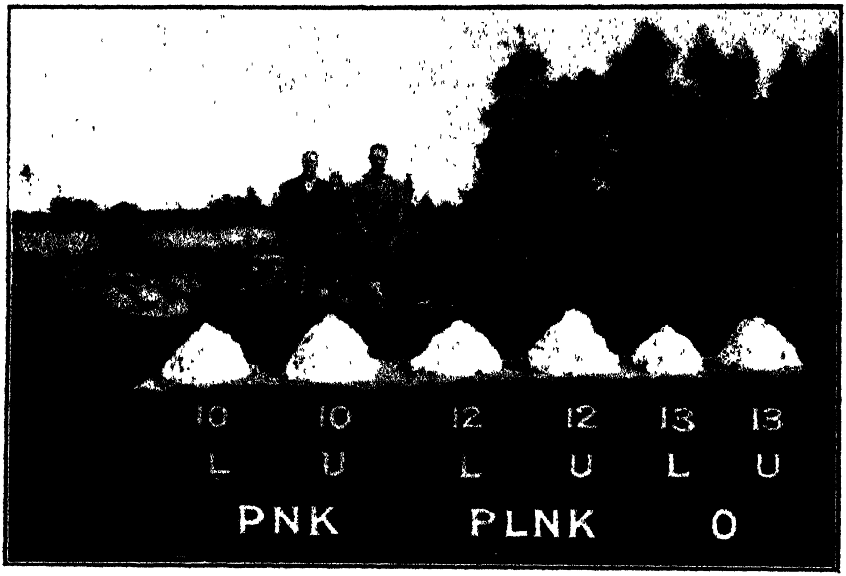


PLATE 6.

A comparison of the limed (L) and the unlimed (U) halves of three plots. Whether fertilized or unfertilized, the depressing effect of the lime is evident.

PLATE 7.

Ca indicates lime. N no lime. The smaller heaps represent the limed and unlimed halves of six control plots, and the larger heaps the limed and unlimed halves of the fifteen fertilized plots. The depressing effect is noticeable in both lots.

was the most profitable and the most certain of the commercial fertilizers for cotton. Although superphosphate alone gives the best results, it does not follow that it should be used exclusively. If superphosphate is used exclusively on cotton, maize, or similar crops, and no legumes turned under or grazed off, or no farm manure added, the soil will become depleted in nitrogen and the yields will fall off—in some cases rapidly. On the other hand, if nitrogen is secured as already indicated, the superphosphate alone may be sufficient to give results for a long time.

(1A) *Drought.*—The plots receiving superphosphate alone as a rule suffered least during dry weather. The yields were time and again cut short by drought, and the plots receiving nitrogen and potash as a rule suffered more decidedly than those receiving acid phosphate alone. The plots receiving cotton-seed meal alone or in combination suffered more from drought than the other plots.

(2) In 68 per cent. of the tests cotton-seed meal alone at the rate of 30 to 100 lb. per acre gave 62 to 200 lb. increase in seed cotton. Cotton-seed meal and superphosphate together produced profitable results, but not on the average as profitable as each used alone. In a few cases more profitable results were obtained. In comparing 50 lb. nitrate of soda with 100 lb. cotton-seed meal, the latter on the average gave slightly better results.

(3) Muriate of potash alone, in amounts from 5 to 25 lb. per acre, produced gains of 20 to 140 lb. per acre of cotton seed. 50 lb. of muriate of potash gave gains of 63 to 87 lb. seed cotton.

(4) Farm manure gave larger gains than superphosphate, cotton-seed meal, or potash. The manure was applied at the rate of ten loads per acre and gave increases from 107 to 227 lb. seed cotton per acre. As nitrogen is usually in excess in farm manure an addition of superphosphate is also advisable.

(5) Lime (hydrated), as has already been mentioned, caused on the average a decrease of 33 lb. of seed cotton per acre.

(6) Mixed fertilizers were on the average not as profitable as superphosphate alone.

The requirements of the Texas soils on which these 151 experiments were carried out in the course of ten years show that phosphates are first, nitrogen next, and potash last of all. "The general use of potash in mixed fertilizers for cotton is thus, we should judge, not profitable," says Dr. Fraps. "Potash should be used only when the farmer is satisfied that his soil needs it, and then in such quantities that it will be of benefit. We therefore advise against the general use of the ordinary complete fertilizer for cotton, containing 8 per cent. available phosphoric oxide, 2 per cent. nitrogen, and 2 per cent. potash. In this connexion we must observe that potash is more abundant in the soil than either phosphoric acid or nitrogen, and is often present in very large quantities."

These results and opinions are remarkably similar to the writer's own experience on various crops in the Transvaal.

WHAT FERTILIZER TO USE.

Dr. Fraps suggests for general use a fertilizer composed of one part superphosphate and two parts cotton-seed meal, or equal parts of the two at the rate of 150 to 200 lb. per acre. There are a number of cases in which the mixture was more profitable than superphosphate alone, or cotton-seed meal alone. The point he wishes to emphasize here is that the individual farmer must study his soil conditions, and use the fertilizer which is best suited to his individual conditions, and the requirements of his soil. To be able to do this he must conduct some simple experiments on his own farm.

REFERENCES.

(1) Fraps, G. S., 1918. "Co-operative Fertilizer Experiments with Cotton, Etc." Texas Agricultural Experiment Station, Bulletin No. 235.

(2) Oosthuizen, J. du P., 1924. "Cotton, Fertilizers, and Crop Rotations." *Journal of the Department of Agriculture*, Vol. VIII, No. 1.

(3) Whitney, Milton, 1909. "Fertilizers for Cotton Soils." United States Department of Agriculture, Bulletin No. 62.

Number of Cattle Slaughtered in Abattoirs.

The January, 1926, Bulletin of Union Statistics shows the numbers of cattle slaughtered at the principal abattoirs in the Union during the years 1924 and 1925 as follows:—

	Oxen Slaughtered.	Cows Slaughtered.	Total.
Year 1924	278,626	53,558	332,184
Year 1925	293,056	78,888	371,944

Thus the percentage of cows slaughtered during these years was 16 per cent. and 21 per cent. respectively.

THE EFFECT OF VARIOUS DIPS ON WOOL.

Report on Experiments in England.

A DIPPING CONTROVERSY.

SHORTLY after its establishment in 1910, the policy of the Sheep and Wool Division in recommending the use of lime and sulphur and caustic soda and sulphur dips for the eradication of scab was severely criticized by certain proprietary dip firms and others. In these criticisms it was stated that the use of either of the above-mentioned dips detrimentally affected the spinning and dyeing qualities of wools dipped in them, and that proprietary dips did not have any effect on wool. Some proprietary dip firms even claimed that their product improved the growth of wool.

The view of the Division was that lime and sulphur and caustic soda and sulphur had no greater deleterious effect on wool than any ot the other dips on the market and that, as its lethal effect on scab parasites was greater, it was a more effective dip for farmers to use when their flocks were infected with scab.

As the use of lime and sulphur at that time was not compulsory when infected flocks were dipped, the criticism against this dip naturally created a doubt in the minds of farmers, with the result that many of them absolutely refused to use it, and satisfactory progress in the eradication of scab was not being made.

In order to put an end to this controversy and to prove that the criticisms were greatly exaggerated, it was decided by the Department in 1913 to have thorough tests carried out with the different kinds of dips in use at that time, to ascertain whether any of such dips affected the wool which had been dipped therewith and, if so, to what extent in regard to its scouring, combing, spinning, dyeing, and finishing properties. It was thought that each of the treated wools should be divided into two lots and two independent reports obtained. Steps were accordingly taken to ask the Bradford Technical College and the Leeds University to put these wools through the different processes of manufacture and to report on the behaviour of the wool during each process.

These institutions kindly consented to do so, the Bradfield Technical College undertaking the one test and Professor Hollis, of the Textile Department of the Leeds University, the other.

DIPPING FOR THE TEST.

Messrs. A. & V. Robertson, of Rolfontein, Wakkerstroom, kindly agreed to supply the sheep required for the experiment, and Mr. R. B. Pickles, who was at that time Sheep and Wool Expert in the Department, was then instructed to select the sheep, prepare the dips in accordance with the directions for each dip, dip the sheep in such dips for two minutes in accordance with the scab regulations, attend to the shearing of the sheep, and dispatch the wool to the above-mentioned institutions.

The sheep used in the experiment were all earmarked, and so Mr. Pickles was able to take the identification number of each sheep and note against such number the dip in which it had been dipped, thereby avoiding any possibility of error. The key to these experiments, as furnished by Mr. Pickles, was kept under lock and key and was not submitted to the gentlemen who undertook the test until after their reports had been received.

The dippings were carried out in three series.

First Series.—In the first series 113 sheep were selected, 4 of which died during the course of the experiments. These sheep had been previously shorn on the 1st December, 1912. The dippings were given in May, 1913, i.e. the sheep had five months' wool, and were shorn in December, 1913. The sheep were divided into ten equal lots, numbered Lot No. 1 to Lot No. 10, and the wool was distributed between Bradford and Leeds as indicated below.

Second Series.—In the second series the experiment consisted of dipping 200 sheep and keeping 20 for control. These sheep had been previously shorn on the 1st December, 1912. The dippings were carried out in September, 1913, i.e. at nine months' growth. Shearing took place on the 1st December, 1913, and the wool was divided into twenty-two lots and distributed as below.

Third Series.—In this series 60 sheep were selected. There were no controls and the animals had been previously shorn on the 1st December, 1912. The dippings were given at eleven months' growth, and the sheep shorn on the 10th February. The wool was divided into six lots as below.

DISTRIBUTION OF DIPPED WOOL.

Bradford.

	Number of Sheep.	Lot Number.	Dip Used.
1st Series ...	11	2	Little's Dip.
" ...	11	5	McDougall's Tobacco Extract.
" ...	11	6	Hayward's Paste.
" ...	11	9	Lime and Sulphur.
" ...	12	10	Undipped.
2nd Series ...	10	11	Caustic Soda and Sulphur.
" ...	10	13	Lime and Sulphur.
" ...	10	15	Little's Dip.
" ...	10	17	Cooper's Dip.
" ...	10	19	Caustic Soda and Sulphur.
" ...	10	21	McDougall's Tobacco Extract.
" ...	10	23	Hayward's Paste.
" ...	10	25	McDougall's Tobacco Extract and Sulphur.
" ...	10	27	Lime and Sulphur.
" ...	10	29	Jeyes' Dip.
" ...	10	31	Undipped.
3rd Series ...	10	34	McDougall's Powder Dip.
" ...	10	36	Kerol.
" ...	10	38	Caustic Soda and Sulphur.

Leeds.

	Number of Sheep.	Lot Number.	Dip Used.
1st Series ...	10	1	Lime and Sulphur.
" ...	11	3	Cooper's Dip.
" ...	11	4	Caustic Soda and Sulphur.
" ...	11	7	McDougall's Tobacco Extract.
" ...	10	8	McDougall's Paste.
2nd Series ...	10	12	Caustic Soda and Sulphur.
" ...	10	14	Lime and Sulphur.
" ...	10	16	Little's Dip.
" ...	10	18	Cooper's Dip.
" ...	10	20	Caustic Soda and Sulphur.
" ...	10	22	McDougall's Tobacco Extract.
" ...	10	24	Hayward's Paste.
" ...	10	26	McDougall's Tobacco Extract and Sulphur.
" ...	10	28	Lime and Sulphur.
" ...	10	30	Jeyes' Dip.
" ...	10	32	Undipped.
3rd Series ...	10	33	McDougall's Powder Dip.
" ...	10	35	Kerol.
" ...	10	37	Caustic Soda and Sulphur.

Shortly after the wools reached the above institutions, the war broke out and seriously delayed the work and the final report. The report on the wools sent to Bradford was received on the 31st July, 1915, but it was decided to delay publication thereof until Professor Hollis's report had been received.

War work, however, prevented Professor Hollis from finishing his report, which had to be done in his spare time; while on the conclusion of the war, Professor Hollis's health broke down, and in consequence the work was still further delayed. His report was eventually received on the 3rd May, 1923, but it was somewhat lengthy and of a highly technical nature, but he willingly consented to abridge it and make it simpler, which, however, delayed the publication of the report still further.

The full reports from Bradford and Leeds are both of a highly technical nature, and a brief summary thereof, with extracts from them, are given below.

REPORTS ON THE TESTS.

Both Bradford and Leeds carried out searching tests of all descriptions, but the essential processes which will reveal the comparative values of the wools are: scouring, combing, spinning, dyeing, and finishing. Should any dip damage the wool seriously, the result will be clearly seen in these processes. These are dealt with below under the heading A, B, C, and D.

Professor Hollis introduces the subject as follows:—

"Consideration of the composition of sheep dips, and the influence of the dipping treatment, suggested that their effect upon the wool might be as indicated by one or other of the following possibilities:—

Dips.

(1) Corrosive or destructive action of the dip, or the tendency of the dip to reduce the strength of the fibres and detrimentally affect the manufacturing properties of the wool, e.g. the spinning, milling, and dyeing properties.
(2) Staining action of the dips causing temporary or permanent discoloration of the wool.
(3) Combination of the components of the dip with the impurities associated with the wools, making the ordinary scouring process difficult and tending to deteriorate the wool by a severe detergent treatment necessary to obtain a clean result.
(4) Chemical action of the dip on the wool substance, tending to alter or modify its affinities for the different classes or types of dyestuffs.

Dipping.

(1) Irregular application or penetration of the dipping solution, consequently irregular treatment of the wool.
(2) Bad effect on the skin and on the health of the sheep, which may be reflected in the subsequent growth of wool, causing the fibres to be irregular in fineness, variable in strength, and staples showing a definite ' break.'

Hence it appeared feasible to arrange comparative tests and experiments, and from the results obtained to classify the wools in order of merit with regard to particular features. For such a purpose the nineteen lots of wool received for examination should have been comparable in all respects and the treatment during manufacture made strictly comparative. *In this case, the materials supplied did not comply with the first requirement and the difference in character and growth did not appear to be solely due to the dipping treatment received.* With materials varying as indicated, there was the choice of either treating the different lots in the same manner or giving to each lot just the treatment required to obtain the best result; for the purpose of this inquiry the former plan was deemed to be the more satisfactory as eliminating a number of variable features.

The variations noted have made it very difficult to finally sum up the merits of the different wools, as such a finding, made statistically, would satisfy neither buyer nor seller; it is therefore recommended that each feature be considered separately."

A.—SCOURING.

Scouring is the process whereby the wool is freed from its natural and acquired impurities. The degree and cost of treatment depend upon the percentage of impurity present. A scouring test will therefore bring out the following points: (1) Which wools require the severest treatment; (2) which wools give the highest yield; and (3) which wools give the best colour.

In series 2, the following results were obtained, the placing being in order of merit as regards colour:—

Bradford: 17, 23, 25, 31, 19, 21, 29, 15, 11, 13, 27.
Leeds: 32, 22. 26, 12, 18, 14, 24, 16, 28, 20, 30.

Note that the undipped lots, Nos. 31 and 32, are not placed top in both cases; also that Lots Nos. 13, 27, 14, 20, and 28, the caustic soda and lime-sulphur dips, are low down on the scale.

Bradford remarks: " In all cases, except three, the ordinary scouring was sufficient to obtain a satisfactory colour of material, but Lots Nos. 9, 13, and 27 (all lime-sulphur) required and received a second scouring."

Leeds: " In actual manipulation of the various wools no serious difficulties were experienced, but in the case of bulk weights more effective scouring would be necessary for Lots Nos. 1, 4, 14, 28, and 33. Lot No. 28 required extra treatment before it was sufficiently clean for manufacturing purposes, and Lot No. 1 was on the borderline and would have shown a better material if it had been more thoroughly scoured. In practice, the scouring treatment is adjusted to the conditions of the materials, and under such circumstances the lots specified, whilst not so good as the other lots, would offer no insuperable difficulties."

Scoured Yield: Leeds.

Per cent.		Per cent.	
52	to	54:	Lots Nos. 16, 18, 20, 30.
48	to	50:	,, 12, 14, 22, 24, 26, 33, 35, 37.
46	to	48:	,, 32, 8.
42	to	44:	,, 1, 7, 28.
40	to	42:	,, 3, 4.

These figures are valuable in that they show the yield to have some relationship to the period of growth of the wool after dipping.

Lots Nos.	1 to 8	(7 months' growth):	average loss 57	per cent.
,,	12 to 32	(2½ ,, ,,):	,, ,, 49.23	,,
,,	33 to 37	(3 ,, ,,):	,, ,, 51.15	,,
Lot No.	32	(undipped):	,, ,, 52.83	,,

In confirmation of the above results as regards difficulty in scouring, Professor Hollis found that, on analysis of the scoured wool, the lime-sulphur lots showed a high percentage of fatty matter. Also on analysis of the scouring liquor, he found that these lots had " killed " the soap to a greater extent than others.

B.—COMBING.

Combing is the mechanical treatment of wool whereby the long fibres (top) are separated from the short fibres (noil). The success of the operation depends primarily on the character and condition of the materials under treatment. Mixed, weak, or irregular wools give a larger proportion of noil compared with uniform, sound, and regular lots.

The following is the order of merit of top and noil yield from results at Bradford and Leeds respectively:—

Bradford: 6, 23, 10, 21, 27,* 36, 25, 9,* 31, 34, 29, 5, 38, 11, 17, 13,* 15, 19, 2.

Leeds: 4, 7, 33, 3, 35, 8, 32, 1,* 26, 16, 18, 14,* 30, 24, 12, 37, 20, 22, 28.*

In both cases the variation between the highest and lowest yielding lots is 16 per cent. Note the positions of the lime and sulphur lots marked * and the undipped lots (Nos. 10, 31, and 32).

Professor Hollis draws the following conclusions from the combing results:—

"The dipping treatment and the length of the period of growth after dipping show considerable influence, both on the percentage of top gained from the greasy wool and on the proportion of top to noil, results which are of the utmost importance to the manufacturer.

The following tables give details:

Average Percentage of Top.

Lots Nos. 1 to 8 (shorn 7 months after dipping): 36.98 per cent. top.

Lots Nos. 12 to 30 (shorn 2½ months after dipping): 40.58 per cent. top.

Lots Nos. 33 to 37 (shorn 3 months after dipping): 40.21 per cent. top.

This variation in yield is primarily due to the partial washing which the wool received during dipping, and those wools shorn within a short period of the dipping date yield the greater percentage of top.

Average Proportion of Top to Noil.

Lots Nos. 1 to 8 (shorn 7 months after dipping): 10.0 to 1.
Lots Nos. 12 to 30 (shorn 2½ months after dipping): 7.3 to 1.
Lots Nos. 33 to 37 (shorn 3 months after dipping): 9.0 to 1.

These figures point in the other direction and show the greatest 'tear' is from wools shorn after the longest interval from the dipping date. This table is most important as indicating the general influence of dipping, although it is admitted that the growth of the wool and the question as to whether this growth has been indirectly influenced by the dipping treatment must also be considered.

It is regretted that none of the lots submitted for examination conformed with the Government's recommendation to dip twice within six weeks of shearing, as it is reasonable to assume from the above results that such wools would show equally good or even better results, because the wool actually dipped would represent not more than six weeks' growth against twenty weeks' growth as given above.

Further, comparison is rendered difficult when allowances are to be made for differences in the periods of total growth of the wool; for it is obvious that under ordinary conditions, wools of fourteen months' growth would have a longer staple, give a slightly better tear, and be more valuable than other wools comprising only twelve months' growth.

Weak wool due to irregular growth, or as a result of dipping treatment, shows badly. For example, Lot No. 20 with a 'break' in staple gave only 6.6 parts of top to 1 of noil; again, Lot No. 28, damaged in scouring owing to its sticky character, presumably the result of the dip used, also gave 6.6 parts of top to 1 of noil; Lots Nos. 22 and 24 are further suggestive examples.

In actual manipulation of the wool, no serious difficulty was experienced from the small excess of fatty matter in certain lots, mainly because of the small amount of wool submitted for treatment, but Lots Nos. 1, 14, 28 (lime and sulphur) caused the squeezing-rollers of the backwasher to become exceptionally dirty.

Test.—Relative values of the combined wools (tops).

Object.—The tops were valued because this stage represents the first, and perhaps the best, stage in manufacture for a thorough examination of the material; the wool is in a more or less clean condition, and to a trained observer the good and bad features become apparent, and are allowed for in fixing its value or allocating a price.

Result.—Top Values.

Lot No. 32,	value 54	pence per pound	...	100.00 per cent
,, 3,	,, 53	,, ,, ,,	...	98.15 ,,
,, 7,	,, 52½	,, ,, ,,	...	97.22 ,,
,, 4,	,, 52	,, ,, ,,	...	96.30 ,,
,, 35,	,, 52	,, ,, ,,	...	96.30 ,,
,, 14,	,, 52	,, ,, ,,	...	96.30 ,,
,, 26,	,, 51¾	,, ,, ,,	...	95.83 ,,
,, 18,	,, 51½	,, ,, ,,	...	95.37 ,,
,, 12,	,, 51¼	,, ,, ,,	...	94.90 ,,
,, 16,	,, 51	,, ,, ,,	...	94.44 ,,
,, 8,	,, 51	,, ,, ,,	...	94.44 ,,
,, 24,	,, 51	,, ,, ,,	...	94.44 ,,
,, 22,	,, 50½	,, ,, ,,	...	93.51 ,,
,, 28,	,, 50¼	,, ,, ,,	...	93.05 ,,
,, 30,	,, 50¼	,, ,, ,,	...	93.05 ,,
,, 20,	,, 49¼	,, ,, ,,	...	91.20 ,,
,, 1,	,, 49	,, ,, ,,	...	90.70 ,,
,, 37,	,, 49	,, ,, ,,	...	90.70 ,,
,, 33,	,, 49	,, ,, ,,	...	90.70 ,,

Conclusion.—The comments previously made again appear to hold good; the undipped wool or material, having only a relatively small portion of its length treated by the dipping solution, is the better. Lot No. 32 is the undipped or control lot. Lots Nos. 3, 7, and 4, which command a good relative price and also showed good average tearage, are lots which were shorn seven months after dipping Lot No. 1 is low on the list owing to being dirty, and Lot No. 8 loses because it is badly stained. The values given are for tops to meet ordinary purposes, but if, for example, fabrics of a particularly good white or a very bright and delicate colour were required, the stained, dingy or inferior tops, as Lots Nos. 8, 16, 30, 20, and 12, could not be used satisfactorily, not even after bleaching.

Owing to the uniform scouring treatment given, not all the tops would pass the colour requirements of the top-maker and more severe treatment would be necessary to reach the colour standard recognized for trade purposes.

The highest valued top is not necessarily made from wool commanding the highest price in the raw state, as the amount of

sinkage or loss in scouring, the tear of proportional weight of top to noil obtained, and the amount of waste produced govern the price which may be paid for the greasy wool."

C.—SPINNING.

In this process the diameter of the drawn top-sliver, i.e. the roving, is further reduced and twist inserted, thereby producing a thread of yarn, which constitutes the raw material for the weaver. The finest, longest, and soundest wools, and wools with the greatest uniformity in respect of these properties, spin best. The commercial value of the yarn depends primarily upon its suitability for the particular requirement, i.e. the type of cloth to be produced from it, but whatever the purpose may be for which the yarn is to be used, uniformity in diameter is an essential. Moreover, the stronger the yarn, the more durable will the cloth be.

Bradford had no difficulty in producing good level yarns in either 40's or 70's count. At Leeds the spinning was kept well within the limits of the wool having the poorest spinning property, and consequently no difficulty was experienced in producing a level and even 40's yarn.

Leeds: " Tensile strength showing lots arranged according to order of merit: Nos. 18, 14, 20, 16, 4, 8, 35, 32, 24, 28, 22, 30, 26, 37, 33, 7, 12, 1, 3.

Notice here the positions of the lime-sulphur lots, viz.: Nos. 1, 14, and 28, and also Lot No. 32, the control lot.

Order of merit as regards evenness in diameter: Nos. 37, 16, 35, 30, 7, 14, 4, 24, 26, 33, 12, 18, 22, 20, 32, 1, 28, 8, 3.

The control lot does not figure too well."

D.—DYEING AND FINISHING.

If the colour of wool is destroyed to any degree, it becomes difficult to obtain a good level and even colour in dyeing, and if sufficient care is not exercised the cloth will show streakiness and quite likely the result may be an unsaleable article. Moreover, should fibres be affected adversely by the dipping solutions, their behaviour during the finishing processes, e.g. shrinkage, steaming, milling, etc., may be abnormal. The handling properties of the finished article will suffer in consequence, thereby reducing the market value considerably.

Bradford: " A five-yard length was cut from each of the nineteen cloths produced, the lengths being stitched together, dyed, and finished as one piece under usual trade conditions. Three separate lots were treated in this way and dyed with three distinct shades: blue, grey, and brown.

Examination of Cloths after Dyeing and Finishing: (1) Colour.—In all the colours there is a variation in shade between cloths made from different lots, which may be classified as ' light,' ' medium,' and ' dark.' The ' medium ' shades are most uniform, the lighter and darker shades are inclined to be uneven and streaky.

(2) *Handle and Finish.*—The medium shades handle better than the lighter or darker shades.

(3) *Classification.*—The cloths may be classified as follows:—

Good.		Fairly Good.		Fair.	
Bradford.	Leeds.	Bradford.	Leeds.	Bradford.	Leeds.
2	37*	15	28†	6	1†
5	30	17	20*	9†	7
11*	32‡	21	26	10‡	16
13†	14†	23	8	31‡	24
19*	18	27†	12*	34	4*
25	22	29	—	38*	3
36	35	—	—	—	33

* Caustic soda and sulphur.
† Lime and sulphur.
‡ Controls.

Shrinkage in Width during Dyeing and Finishing.—The average shrinkage in width during dyeing and finishing was 18.5 per cent., the maximum being 20 per cent. and the minimum 17 per cent. There is only a variation of three-quarters of an inch in all the cloths.

Finished Cloths.—A comparison of the finished cloths does not reveal the same striking differences which are noticeable in the various lots after scouring, combing, and spinning, the gradation between the different classes being so slight as to be only noticeable to an expert. The strength and elongation tests indicate considerable variations, but these do not coincide with the grouping of the different lots based upon the processes up to and including spinning. It should be noted, however, that the cloths made from Lots Nos. 6 and 10, which had a high yield of top to noil, come under the heading of 'Fair,' whilst cloths made from Lots Nos. 2 and 19, which had a low yield of top to noil, come under the heading of 'Good.'"

Dyeing and Finishing (Leeds).—"Test for quality of natural colour after piece-scouring:—

1st class: Lots Nos. 1, 32, 7, 28, 4, 35.
2nd class: Lots Nos. 22, 24, 26, 14, 32, 37, 33.
3rd class: Lots Nos. 18, 12, 30, 20, 16, 8.

This test for whiteness and brightness of the natural-colour effect is the best in the whole series, because of the intimate mixture of the fibres in each lot by the processes of manufacture. The lots placed in class three are of poor quality, particularly Nos. 16 and 8, which are badly stained.

In a test for milling property, the average shrinkage was 20 per cent., the maximum being 22.42 per cent., and the minimum 18.10 per cent. Milling demands a high standard of quality in the material, and the wools that mill well represent the best value. The milling properties vary only slightly and then apparently with the quality and length of the wool and not in accordance with dips and dipping treatment, except so far as the dipping treatment have altered the growth of wool by its influence on the health of the sheep.

Actual Dyeing Trials.—Summary of results to show the materials in order of merit according to their dyeing properties:—

1st class: Lots Nos. 32, 26, 33, 1, 28, 35.
2nd class: Lots Nos. 30, 22, 7, 14, 3, 18, 4, 24.
3rd class: Lots Nos. 37, 20, 12, 16, 8.

The findings are simply from the wools under examination and require confirmation before being considered as definite for general purposes. The results show conclusively that for dark and medium shades the dyeing properties vary only slightly and the dyer could modify his treatment and match or shade to sample without much difficulty.

In many cases, the patterns comprising the whole range have received the same dyeing treatment and would be passed and accepted by the buyer in the ordinary way.

In the lighter and brighter colours differences appear relatively greater; the small amount of colouring matter used enables the slight differences in affinity for colour to be noted. Lots Nos. 30 and 37 show a maximum difference, the former taking the colour somewhat easily, whereas the latter is lighter in shade in each case. This variation does not appear to be entirely due to dip or dipping, as other lots having received similar treatment do not show the same result.

Handle.—Difficulty is experienced owing to the standard known to the person making the examination; in some cases a soft silky feel is required and in others a soft, full, or 'woolly' handle is desired. However, it does not appear that the dipping treatment seriously affected the softness of handle of the finished fabric, and this feature seems to vary almost solely with the quality of the wools.

Test.—Valuation of the finished fabrics.

Result.—Table of lot numbers in order according to trade valuation of the finished fabrics made from the different wools: Lots Nos. 22, 37, 32, 24, 20, 26, 35, 33, 28, 7, 14, 30, 16, 18, 12, 4, 8, 3, 1.

Conclusion.—The final valuation is by the trader, who considers (1) material; (2) excellence of manufacture; (3) quality of the finished result; and apportions values accordingly.

In this investigation the manufacturing treatment has been uniform throughout, therefore the merits of the materials submitted are adjudged to be in accord with the order of arrangement of the lot numbers in the table given above.

GENERAL CONCLUSIONS.

Important and interesting tests and experiments were made, many of which cannot be referred to in this shortened report. Amongst others may be mentioned Lot No. 38; this batch of material comprised rough wool and waste from all the lots and, according to some authorities, such a blend should have produced a mixture effect in the dyed fabrics; in these tests, however, the results were, for all practical purposes, solid colours. A corresponding test was made by mixing the noils from all the different combing lots to form a blend which was carded and spun on the woollen system of yarn manufacture; samples of this yarn, obviously inferior in colour to the best of the straight lots made into worsted yarn, were dyed bright shades which showed no sign of the mixture effect.

From the work done, the answers to the suggested possibilities outlined at the commencement of this abridged report are as follows:—

Dips.

(1) Dips have, more or less, a destructive action on the wool.

(2) Staining action by the dip does take place, and in some cases the discoloration is permanent.

(3) Dips cause the scouring treatment to be more difficult.

(4) Slight changes in affinity for dyestuffs were noted when dyeing staples of wool from respective lots, but this feature is not proved as directly due to the dip used, because the undipped portions of the staples did not always agree in colour, and, further, considerable variations were found even in the same lot of wool.

Dipping.

(1) Defects due to irregular application and penetration of the dipping solution can only be presumed. The limited number of experiments made by dyeing the staples in tuft form supported the theory, whilst when staples were dyed as units such irregularity could not be definitely established.

(2) From the variation in growth of the wool and from results obtained by dyeing wool staples, there is little doubt that this indirect effect is the probable cause of irregular materials."

GENERAL DEDUCTIONS BY THE DEPARTMENT OF AGRICULTURE.

From the above results it would appear—

(1) That all dips have a somewhat prejudicial effect on wool. However, the fact that the "control" lots in both experiments did not give the best results in all the processes through which the wool was passed suggests that some factors other than dipping must have caused the different and somewhat conflicting results obtained. (See comparative combing results table.) In this table the lots comprising series 2 should have occupied the same relative positions, both in the Bradford and Leeds tests, if the raw material had been identical in both cases.

(2) That the lime and sulphur and the caustic and sulphur dips render the wool more difficult for scouring, but offer no insuperable difficulties.

(3) That in the subsequent processes, the lime and sulphur and caustic and sulphur dipped wools show up favourably. (Compare combing and spinning results.)

(4) That dipping has no detrimental effect on the dyeing and finishing properties of wool. This is borne out by Professor Hollis' statement: "In many cases the patterns comprising the whole range have received the same dyeing treatment and would be passed and accepted by the buyer in the ordinary way." Also see his remarks on Lot No. 38, comprising the waste from all the lots.

(5) That the sooner the dipping can be carried out after shearing, the less effect the dip is likely to have upon the wool. The tearage, i.e. the proportion of top to noil, proved to be bigger in series 1 than in either series 2 or 3, whereas the scoured yield showed the reverse, obviously due to the scouring action of the dip.

However, it is not recommended to dip sheep straight from the shears in arsenical dips. Time must be given for the wounds inflicted by shearing to heal, otherwise blood-poisoning may result and cause the death of animals dipped.

In conclusion, it is desired to express the Department's thanks and appreciation for the valuable services rendered in connexion with the experiments: to Professor Hollis, of the Leeds Technical University; the Leeds Technical University, for the use of its machines by Professor Hollis; the Bradford Technical College, for the use of its machines; Professor Barker and the staff of the Bradford Technical College, by whom the tests were carried out; Mr. T. H. Moore, of Messrs. Moore Bros., wool merchants, Huddersfield, for organizing the experiments and the assistance which he from time to time gave Professor Hollis; Messrs. A. & V. Robertson, for the generous loan of the sheep used in the experiments; and also to Messrs. Mallinson, Eales, and Pickles, at that time members of the Sheep and Wool Division of the Union, for the work performed by them.

Outbreaks of Animal Diseases: January, 1926.

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Total for Jan., 1926.	Total for Calendar Year 1925.
East Coast Fever	2	1	—	—	2	5	69
Mange	6	3	2	2	4	17	527
Anthrax	50	5	17	11	34	117	970
Dourine	—	—	1	—	—	1	21
Glanders	—	—	8	—	—	8	48
Tuberculosis	—	—	3	—	—	3	11
Epizootic Lymphangitis	—	—	—	—	—	—	1

HANDLING, PACKING, TRANSPORT, AND STORAGE OF EGGS FOR SOUTH AFRICAN AND OVERSEAS MARKETS.

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GOLDEN RULES.

THE future development and progress of the poultry industry in South Africa depend to a great extent on the production and marketing of eggs of the best quality. Such eggs, whether disposed of in our own or overseas markets, should carry a guarantee of quality irrespective of grade. It is on a quality basis that we must depend to maintain our position in the world's markets. The fact is not perhaps appreciated to the extent it should be that we in South Africa, having a comparatively small consuming population, have to depend on the disposal of our surplus production in the overseas market for the development of the industry on national lines, and to do this successfully we must produce an article of at least equal quality, if not superior, to that produced by the other exporting countries with which we have to compete. Hence the importance and necessity of producing a first-class egg and marketing it in the very best condition possible. It is only for the best that top prices are obtainable, which all producers should aim at securing.

The apparent indifference of a large number of producers as to how their eggs are marketed is responsible to a great extent for the poor prices often obtained; this can be verified by visiting the morning market of almost any town in the Union. There is usually no attempt at grading, consequently the small, large, clean, dirty, and misshapen eggs are all put together, oftentimes in a most unsuitable, unattractive container, so that one would not feel disposed to give other than an indifferent price for such a "mixed" commodity. If the producer is not sufficiently interested in his product to put it up for sale in an attractive manner and to be able to give a guarantee as to its quality, he must be prepared to accept an indifferent price.

Further, it is of the utmost importance that care should be exercised in the production of the egg, otherwise improved methods of marketing will be of little value unless the conditions under which the eggs are produced are such as to ensure its keeping qualities until it reaches the consumer.

* This article was originally written by the late Mr. W. O. John, Lecturer in Poultry Culture at the Elsenburg School of Agriculture, and published in 1918 by the Department of Agriculture as Bulletin L.S. 42. It has now been revised by Mr. A. Owen John.

The following rules, if observed, will be conducive to the best interests of every poultry keeper individually, also the progress and prosperity of the industry as a whole:—

1. Feed the hens on clean wholesome food.
2. Provide an ample supply of clean cool water. When it is considered that an egg contains 72 per cent. of water, the necessity of cleanliness in this respect is self evident.
3. Keep the poultry houses clean: eggs laid in filthy surroundings are tainted when collected.

   Also provide sufficient nests containing ample nesting material; for which clean dry straw, chaff, or grass are suitable.
4. Eggs must be collected at least twice daily during the hot summer weather, and once daily during cool weather.
5. Do not permit the male bird to run with the hens that produce the eggs for market; it is quite unnecessary, and further, *unfertile* eggs are 50 per cent. superior to fertile eggs in their keeping qualities.
6. The male bird should be removed from the breeding pens at the end of the breeding season, as no more fertile eggs are then required; by so doing you will eliminate the danger of the " bad " egg.

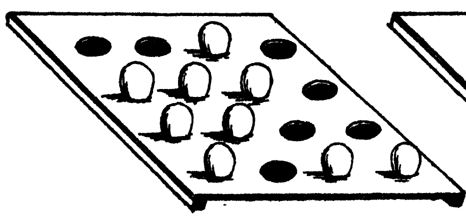


Diagram No. 1.
Correct Position.

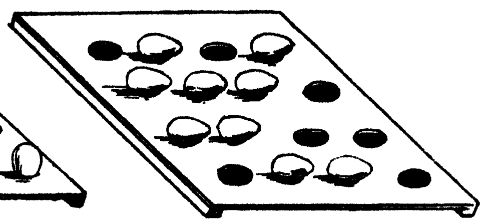


Diagram No. 2.
Incorrect Position.

RULES FOR HANDLING.

1. Collect eggs in clean baskets; see that the hands of the collector are clean, as it is useless having clean nests if the collecting receptacles or hands are dirty.
2. Place the eggs in a cool, dry, darkened room, which is airy, but not draughty.
3. Eggs should not be kept in the same room with fruit, vegetables, etc., as they absorb odours very quickly and consequently deteriorate in value.
4. When collected, the eggs should be placed in trays or racks with the large end up; this is the correct position (see Diagrams Nos. 1 and 2).
5. During wet weather use covered egg baskets when collecting, as dampness is harmful to the keeping qualities. Dampness produces mould fungus and grey and black rot in fertile or unfertile eggs.

The washing of eggs is most detrimental, for if the surface of an egg has once been wetted its keeping qualities are greatly impaired, and if placed in cold storage bacterial infection develops within thirty days.

6. Use the misshapen, badly stained, and very small eggs for home use.
7. Market eggs as regularly and frequently as possible, at least twice weekly, particularly during the summer months.
8. Do not pack eggs with very thin shells, or those that are slightly fractured; these are easily broken in transit thereby spoiling many others.

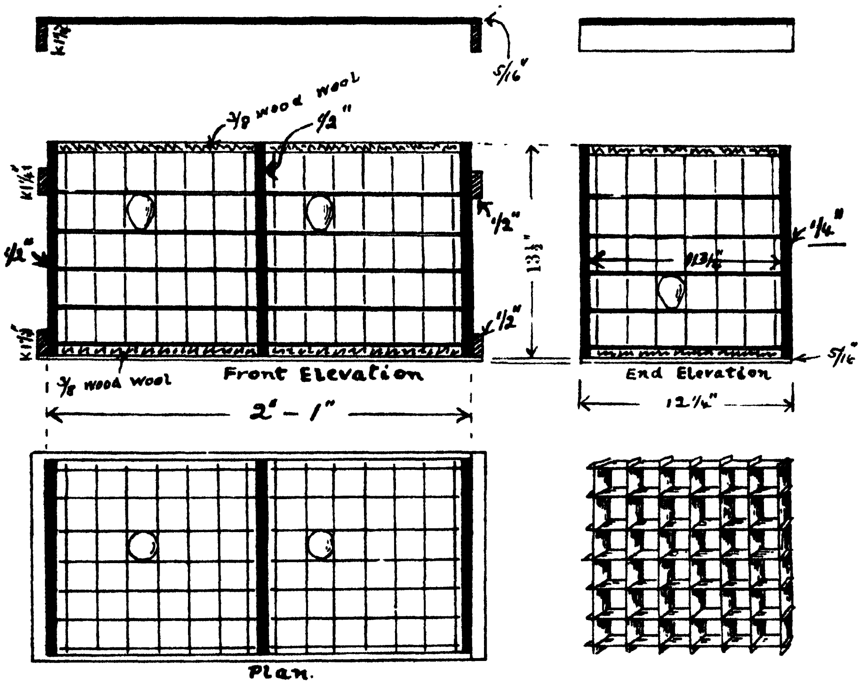


Diagram No. 3.

Particulars of Export Egg Case.
NOTE.--Depth of case for 16-lb. pack and upwards to be 13¼ inches.

9. On no account should eggs of doubtful quality be packed; this decreases the value of the goods, besides being dishonest.

EGG BOXES.

An important point when eggs have to be transported by rail, either to the market for sale or to the nearest centre for cold storage, is that they be packed in standard cases, i.e. cases of uniform size.

Diagram No. 3 illustrates a box, showing all its essential details; it is the standard box for export purposes as provided for in the Government Egg Export Regulations.

The standard export egg box for all packs must be of the following dimensions:—

Compartments.—11¾ in. by 11¾ in. square by 13½ in. deep.

Length.—26 in. outside measurement overall including cleats; 25 in. outside measurement excluding cleats; 24 in. inside measurement of two compartments including centre partition.

Width.—11¾ in. inside; 12¼ in. outside overall.

Depth.—13½ in. inside; 14⅛ in. outside overall.

Specification for *standard* boxes in shooks:—4 tops and bottoms, 26 in. by 6 in. by $^5/_{16}$ in.; 4 sides, 25 in. by 6½ in. by ¼ in.; 4 ends, 13½ in. by 5¾ in. by ½ in.; 2 centres, 11¾ in. by 6¾ in. by ½ in.; 6 cleats, 12¼ in. by 1¼ in. by ½ in.

The two centre pieces to be joined together by two corrugated metal clips.

The top of each side piece to be branded "Eggs With Care."

½ in. space between two pieces forming sides to permit of ventilation.

¼ in. space between two pieces at each end to permit of ventilation.

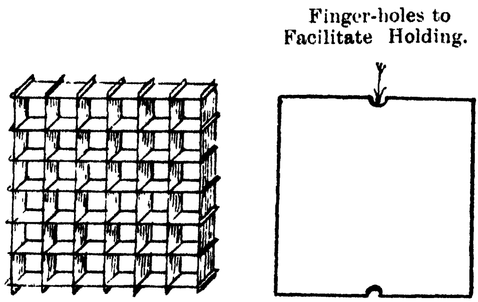


Diagram No. 4.

Cardboard Carton. Cardboard "Flat" or Board.

Usually when smaller quantities are dispatched to local markets, cases of various dimensions and designs are used which are most unsuitable, as it is impossible to pack such in the railway van satisfactorily, consequently, with the numerous gradients which have to be negotiated, such cases move out of position resulting in numerous breakages. This can be remedied to a great extent by using a uniform box (this is strongly recommended), which should be a unit of that shown in Diagram No. 3.

The wood used in the manufacture of egg cases must be well seasoned and perfectly dry. There is a grave danger in using wood which is not quite dry, as it produces mildew, thus causing later on grey and black rot fungoids in the eggs. A clean, white wood, free of resin, is best for this purpose, as it is practically odourless, which is another important factor.

CARDBOARD CARTONS AND BOARDS.

All cartons and sheets or flats should be made of clean white "Bender pulp board," the thickness of which must not be less than 0.028 of an inch or 0.70 mm. calliper. Sheets or boards should be

provided with finger-holes to facilitate handling. In no circumstances should soiled, or second-hand cartons, or boards be used.

The cartons for "smalls," 13½ and 15 lb. packs must be 11½ by 11½ inches square by 2¼ inches deep, each compartment in the carton being 1⅝ by 1⅝ inches square by 2¼ inches deep. For the 16-lb. pack and upwards, including duck eggs, the size of cartons are 11½ by 11½ inches square by 2½ inches deep, each compartment in the carton being 1¾ by 1¾ inches square by 2½ inches deep.

It is most important that the cartons and boards, or flats, be of sufficient strength to ensure the conveyance of eggs in the best possible condition. The use of thin, flimsy cartons and boards made of weak

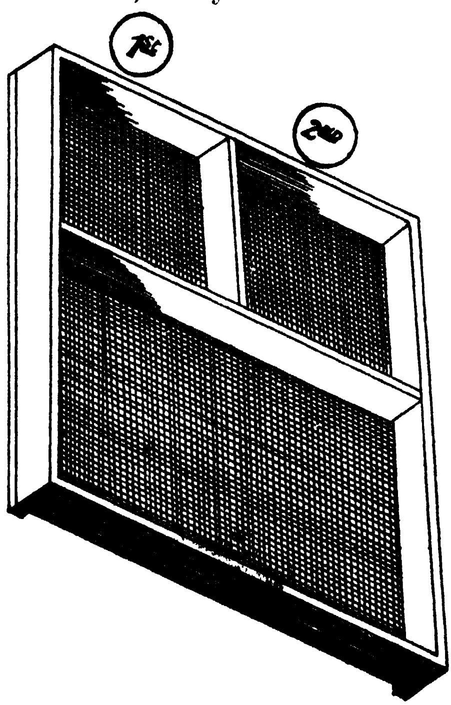


Diagram No. 5.
Grading Tray.

cardboard is responsible for numerous breakages in transit and consequently disappointment and loss of business.

GRADING.

Before packing, it is essential that eggs be graded for size. The grades provided for in the Egg Export Regulations are necessary for overseas market requirements.

For our own markets the following grades are suggested as meeting the demand:—1st grade egg for South African markets should be 24 oz. and over to the dozen, or 2 oz. and over per egg; 2nd grade eggs 21 oz. per dozen and under 24 oz., or 1¾ oz. per egg. Except for export purposes, there has been practically no grading practised. It is certainly time this was done, as it would prove of considerable benefit to both producer and consumer alike.

The method of grading is by comparison, first taking an egg of average size for the grade desired, holding this in the left hand, and with the right selecting all those of similar size from the eggs to be graded, periodically checking the accuracy of the work by weighing a dozen eggs on the scale. With a little practice one may become quite proficient at this work, handling a large volume of eggs in a short space of time.

However many grades the eggs may be divided into, each should be of guaranteed quality; the grade itself represents the size or weight of eggs per dozen or hundred as the case may be, not the quality of the contents, which at all times should be above question. All thin-shelled, cracked, abnormally shaped, dirty, or soiled eggs should be used for home consumption.

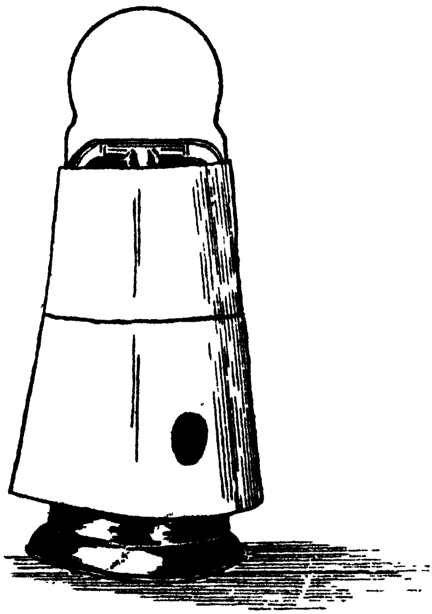


Diagram No 6.
Storm Lantern as Egg Tester

Diagram No. 5 shows a suitable tray for egg grading. Grading for colour is not recommended for export overseas, owing to the fact that our coloured or tinted eggs are not sufficiently deep in colour or tint to compete with those produced elsewhere, particularly in France and Holland, which are very rich in colour and usually obtain a high price on the London market. Therefore it is recommended that South African eggs be packed mixed, brown and white in even quantities. For our own market requirements grading for colour may be carried out according to market demand, providing an enhanced price is obtained for eggs so graded.

TESTING.

Having graded the eggs, they should then be tested or "candled." It is unnecessary to purchase an appliance for this purpose, as this can be made as follows:—

Make a frame of four light strips of wood equal in size to the window of your egg room, cover with stout canvas or brown paper; this frame or screen is then fixed to the window by means of wooden buttons. At a convenient height cut an egg-shaped hole in the screen slightly smaller in size than a normal egg. Then darken the room, place an egg against the hole in the screen, and the contents will easily be seen. If it is desired to test at night-time an ordinary storm lantern with a piece of cardboard fixed around it as shown in Diagram No. 6 makes quite an efficient tester.

Where large quantities of eggs have to be tested daily, such as at egg circles or collecting depots, eggs are tested in bulk. For this purpose a darkened testing room or cabinet should be available, the eggs to be arranged in light but strong ply-wood trays, each to hold from 80 to 100 eggs; the trays are arranged in tiers on a fairly low table, with a space of from 5 to 6 inches between each tray.

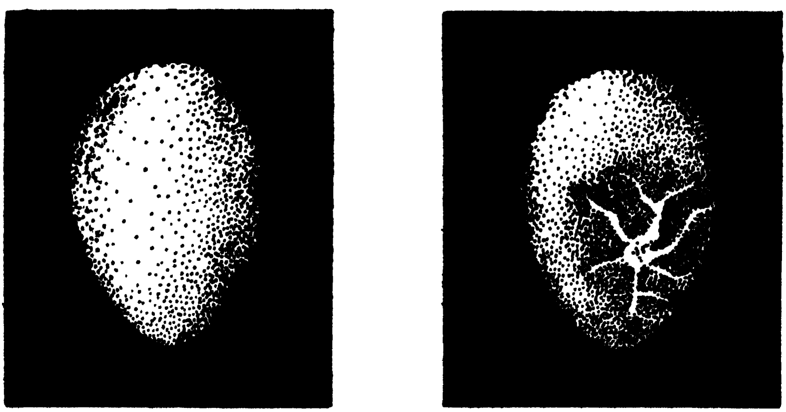


Diagram No. 7.

Sound Shell.

Fractured Shell which may only be detected under test.

An electric bulb is used, fixed to a piece of piping 18 inches long with a few yards of electric wire attached; this is inserted underneath each tray when the contents of each egg can easily be seen.

However fresh eggs may be, it is necessary to test them before being sold, as it is not an uncommon occurrence for an egg to be laid out in the hot sun where it may remain for 4 or 5 hours before collection, by which time it is anything but a desirable commodity for the breakfast table, although "new laid," and it is only by testing all eggs that a guarantee of quality can be given.

The objects to be looked for when testing are, blood spots or rings, cloudiness or staleness, germination. Further, it is possible for an egg to be fractured or cracked which may not be perceptible except under test; such an egg, if packed, would most probably break in transit, spoiling the contents of the box and depreciating the value.

PACKING.

The egg boxes should be well aired and perfectly dry prior to being filled. Spread ⅜ inch of clean, white, dry woodwool evenly over the bottom of the case; on this place a plain board (cardboard sheet), then the cartons; press down firmly and fill the divisions with eggs, small end downward. Each carton holds three dozen eggs; thus there are 6 dozen in one layer of an egg export case. When the first set of cartons is filled place on top the plain board (cardboard sheet), then another set of cartons and so on until the case is full, containing 360 eggs (export case). On the top layer place a plain board, and on this spread a layer of woodwool ⅜ inch thick. The case is now ready for the lid to be nailed on.

Diagram No. 8 shows clearly what is meant. On the right is a full case, in the middle a case showing the woodwool on top, and on the left the case is seen with the lid on, nailed down and ready for market.

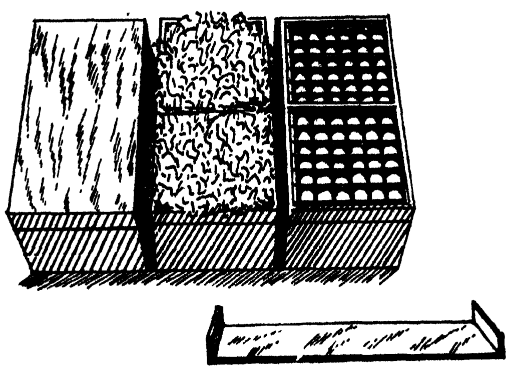


Diagram No. 8.
Method of Packing.

In no circumstances should second-hand cases, cartons, or boards be used when eggs are to be placed in cold storage. With regard to smaller quantities of eggs for local markets, the same procedure is recommended, using a smaller case which should be a unit of the export case for the reasons previously stated.

It is important that only one grade of eggs be packed in each case. Where there are producers of either white or tinted eggs respectively, naturally they cannot be expected to pack a mixed (tinted and white) case.

Producers should make a special point of obtaining the correct size of carton for the grade of eggs to be packed. The standard egg boxes and fillers are obtainable at various centres in the Union, the producers or packers should, however, be sure that the material is of the requisite quality, and that both boxes and fillers are according to standard requirements. Should any doubt or difficulty arise in this connexion, the Poultry Officer at the School of Agriculture for the area concerned should be communicated with, from whom the necessary information can be obtained.

TRANSPORTING.

Cases should be carefully packed on the cart or wagon, standing evenly, so as to avoid undue shaking or jolting. Always cover the cases with a sail or clean sacking to prevent heating from the sun, or the possibility of getting wet from rain; further, the covering over of the cases will prevent undue evaporation which takes place rapidly during heavy winds unless protected in some way. At the railway station request, for the same reason, that the cases be placed under cover.

Eggs should be dispatched either by fast goods or passenger train.

With the precautions suggested they should reach their destination without undue breakages or practically any deterioration.

MARKETING.

To market successfully and obtain the best possible all-year-round prices, it is not only necessary to produce eggs of good quality, properly graded and packed, but to be in a position to forward supplies regularly throughout the year.

When making contracts with large consumers such as hotels, hospitals, educational institutions, etc., they require not only a sound article, but an assurance that a regular supply will be forthcoming weekly throughout the year. Therefore when making contracts the available supply should be based on the maximum autumn and winter production. After the first year this obstacle can be overcome. Should suitable cold storage accommodation be available, full advantage of it should be taken during the season when eggs are plentiful. Eggs can and are being kept without any deterioration for 4 to 5 months. In this way the producer is able to enlarge his contracts in the second season's operations and level up prices for the year. To obtain maximum results it is recommended that producers combine to market co-operatively. In this way both large and small producers improve their position, as instead of competing with each other as otherwise would be the case, they join forces to their mutual benefit, at the same time proving a decided benefit to the consumer in being able to sell an article of guaranteed quality at a reasonable price all the year round, and prevent that fluctuation in prices which is not good for either the producers or consumers or for the industry as a whole.

Further, by co-operative effort a more uniform quality of product is ensured and the principle can and should be extended to the purchase of supplies such as foodstuffs, appliances, etc., all of which will cheapen the cost of production.

STORAGE.

Home Markets.—It is important when storing eggs for home markets that they be stored as far as possible in the town in which they are to be sold, the object being to save unnecessary costs and to be in a position to take advantage of the market when suitable.

Overseas Markets (Export).—All eggs intended for export overseas should be stored at coast ports pending shipment, and at the

nearest port to the district in which they are produced. A long rail journey does not improve an egg, hence the necessity of curtailing it as much as possible by railing to the nearest export centre.

Eggs are highly perishable and easily affected detrimentally by external conditions.

When stored at the export port, eggs are shipped direct overseas with the least possible change of temperature (just the time taken in conveying them from the cold storage rooms on shore to those on the ship) and landed on the European market during the months when the external temperature is low. This results in practically no detrimental changes in condition. Cases on being opened by consumers are then found in good condition, resulting in good prices being paid for South African eggs.

CHILL-ROOMS.

It must be distinctly understood that, whether storing eggs for home or oversea market, suitable chill-rooms are an absolute necessity. Of the various methods of cooling egg chill-rooms, the best for the purpose is known as "air cooled," i.e. the means of cooling (generally a system of pipes) is not located in the room itself, but is placed in a separate and insulated space conveniently outside the storeroom, and connected with the latter by airducts and suitably arranged shutters for distributing and regulating a circulation of refrigerated air, the circulation being effected by air propellers, driven by power. In well appointed storerooms the refrigerating machinery and air propellers are in continuous operation in order that there may be no change in temperatures and the circulation of the air. Not only are these maintained and constantly recorded, but also the degree of humidity of the air in the storeroom is regulated carefully.

TEMPERATURES.

The correct temperature for long storage is 35° F., i.e. for eggs stored for four and a half to six months. When stored for two to three months, eggs will be all the better if maintanied at a temperature of 38° F. Therefore, taken all round, 35° to 38° F. is approximately correct. It may be well to state here why rooms with exposed ammonia tubes are unsuitable. All such exposed tubes, as can be seen by any one when visiting a refrigerating plant, are covered with rime (white frost). Now it is well known that freezing point is 32° F., and, as mentioned, the temperature for eggs should be 35° or 3° above freezing point; therefore, with exposed tubes at 35° F., there must be some moisture which is detrimental to the keeping qualities of the eggs.

FROZEN EGGS.

On no condition should eggs be frozen; owing to the fact that any frozen product, when once removed from the freezing temperature, deteriorates very rapidly in keeping qualities; in this respect eggs are highly perishable. Also, when a case is withdrawn from storage, the contents are not sold at once; in small shops a case of eggs may meet all customers' requirements for from 10 to 12 days.

Therefore, in storing eggs, the following points should be kept in mind:—

1. Store at a temperature that will give the best results for the longest possible period after withdrawal. (Experiments have proved that the temperatures indicated give the desired results.)
2. If for export, test closely and pack carefully, as any breakages or faulty eggs detract from the general value of the consignments.
3. For home markets exercise the same caution; careful testing, grading, and good packing help to build up a sound reputation and ensure good prices.

The cost of storage works out roughly at 3d. per case (30 dozen) per week or part thereof.

STORED EGGS *versus* NEW-LAID EGGS.

Freshness is not the only vital point in the quality of eggs. Owing to the readiness with which eggs are spoiled, the term "fresh" has become synonymous with the idea of a most desirable quality in eggs. In actual fact, the age of an egg is only one of the factors which affect the quality. For example, an egg forty-eight hours old can be of poor quality if it has been laid beneath a manger in damp stable litter (a frequent nesting place on farms); this is also the case when eggs are laid outside in the yards in hot summer weather, when the frequent rain storm leaves the ground in a steaming condition, and the eggs gathered swarm with bacteria and, strictly speaking, are unfit for food.

Now eggs held in cold storage under proper conditions for five or six months would be of a far higher quality than a "fresh" egg laid under the above conditions. It is well that the public be made fully acquainted with this fact. At present many consumers think that eggs kept in cold storage are of inferior quality. This is not so, as eggs stored under first-class conditions are as good at the end of five to six months as when placed in storage, providing they are sound when put in. Proper cold storage will maintain a good egg in a sound condition, but it will not make a "bad" egg good.

WITHDRAWING FOR MARKET.

When eggs are taken out of chill-rooms, they should not be removed at once from a temperature of 35° F. to high outside temperatures of from 70° to 90° F. This causes what is known in the trade as "sweating" (due to condensation of moisture), and is detrimental to good quality eggs. The correct procedure is to remove the number of cases required from the chill-room to the air lock (this is naturally several degrees higher in temperature than the room itself); on the following day the cases may be removed to the store; and a further twenty-four hours should elapse before the cases are opened and the contents unpacked. These precautions obviate the possibility of sweated eggs. In some countries the process to prevent "sweating" is carried out somewhat differently. The eggs withdrawn for market are subject to what is known as a "defreezing" process.

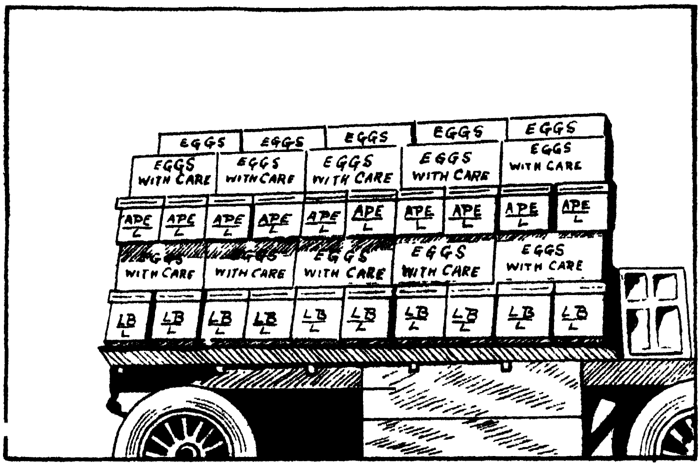


Diagram No. 9.

Motor Lorry loaded up ready to start for Docks. Sail off for photographic purposes.

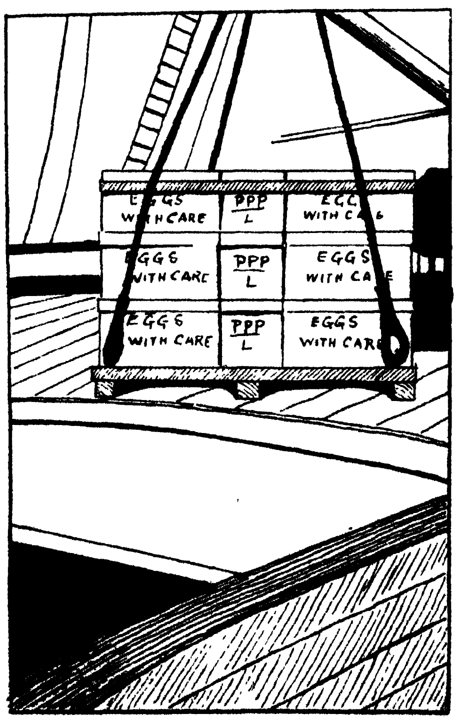


Diagram No. 10.

Lowering Eggs into Chill-rooms on Board.

The plant for this purpose is situated in close proximity to the chill-rooms and consists of a room built of brick. At the one end there is a large motor-driven suction fan, at the other end of the room there is an opening (about the size of an ordinary doorway) to the atmosphere. Covering this opening there is a screen which acts as a filter, also another screen or filter is situated about six feet in the room. The cases of eggs to be treated are placed in alternate rows on end between this second screen and the fan which draws the air through the chamber, drying off any moisture on the eggs owing to the change of temperature. The screens or filters, while preventing undue evaporation, also prevent dust and foreign matter coming in contact with the eggs.

WITHDRAWAL FOR SHIPPING (EXPORT).

For export the eggs are withdrawn in an entirely different manner. The cases are taken direct from the chill-room and loaded on motor lorries. Diagram No. 9 shows such a motor lorry loaded, but with the sail or tarpaulin removed to show the contents of the load. Or again, where convenient, a refrigerator or insulated truck is used to convey the eggs from the chill-room to the jetty or dock side.

The unloading at the docks is carried out by porters, the cases being carefully handled to avoid jolting, and are packed on a flat platform in lots of twelve or twenty-four, as the case may be. At each corner of the platform are eye-bolts to which rope slings are attached. Diagram No. 10 shows the platform with its load of eggs being conveyed by electric crane from the jetty to the hold of the ship.

SHIP'S CHILL-ROOMS.

These are fumigated at the port of loading to avoid the possibility of mildew, and are maintained at a uniform temperature of 35° F.; here again there are no exposed ammonia pipes.

The reasons why conditions differ when eggs are withdrawn for export are that in the latter case the eggs are taken from one chill-room to be almost immediately placed in another (i.e. in the ship). The period of exposure to external temperatures does not exceed twenty to thirty minutes, as loading at the chill-rooms and off-loading and transferring to the ship are carried out rapidly.

EXPORT CONTROL.

All eggs are exported under Government regulations and are inspected in accordance therewith at the port of shipment. Copies of the export regulations may be obtained on application to any of the Schools of Agriculture, or to the Department of Agriculture, Pretoria.

CO-OPERATIVE EGG CIRCLES.

An Investigation into their Condition and Possibilities.

As a result of an investigation into the condition of the various Co-operative Egg Circles of the Union, the Division of Economics, Markets, and Co-operation points out that all the circles follow practically the same methods.

Each member stamps his or her number on the eggs: on the point of fertile eggs and on the side of infertile eggs. Although the eggs are sent in proper and approved boxes to the depots of the circles, nothing has yet been done to ensure the uniformity of these boxes. In the efficient marketing of eggs, standardization of containers is an essential factor.

The eggs are weighed upon receipt, and payment is made not according to the number of eggs, but to weight. Only sound eggs are paid for; the bad ones are destroyed. The eggs are tested by means of a strong electric light and are graded into the following classes:—(*a*) New-laid; (*b*) Fresh; and (*c*) broken (quite an appreciable amount of these).

No attempts are made (excepting by a few circles) to sell eggs on the local markets. It is difficult to state with any degree of certainty whether this is due to lack of funds, shortsightedness on the part of the directors, or contempt for the local markets; but it is beyond doubt that the egg circles are paying very little attention to organizing their business in such a way as to provide adequately for local demand.

The greatest weakness of the egg circles is their system of distribution. Little effort is made to secure contracts with Government institutions, railways, universities and school hostels, hotels, boarding-houses, etc. Advertising is to all intents and purposes not made use of at all. Hundreds of people do not know of the existence of an egg circle in their own town, not to mention the matter of prices and quality.

Payments are made monthly in cash. The average price obtained is satisfactory, but those circles which gave attention to the development of local markets, paid the highest average prices to their members.

On the 30th June, 1925, the number of rural and urban poultry farmers was about 82,000 and 28,000 respectively, and out of this total of 110,000, only 1,184 were members of egg circles. The number of fowls in the Union was just over 9 million in 1922. In 1925 the egg circles barely handled 10 million eggs; in other words, provided the number of fowls remained constant, only one egg per fowl per annum was handled by the egg circles.

With the exception of one circle there is hardly any marketing of poultry, dressed or otherwise. Unless the circles give more attention to this side of their marketing, the chances of improvement in the quality of table poultry are slight; moreover, under the present marketing system, producers receive very little encouragement to breed and to feed the right type of fowl, turkey, duck, or goose.

As an outcome of its investigation the Division recommends:—

(1) As in the case of all agricultural products, standardization and efficient grading of poultry and eggs are absolutely essential both in respect of quality and of containers, and methods of packing.

(2) It is essential that the surplus production be exported; but on the other hand, more attention should be given to the development of local markets.

(3) The hygienic condition of many fowls and eggs is none of the best. As the necessary regulations have been passed, these should be properly carried out.

(4) As many of the weaknesses of poultry farming may be ascribed to ignorance, education is very necessary, and it may be desirable to divide the Union into about five sections, with a well qualified extension officer stationed in each, who by personal contact with the farmers would be able to give the necessary advice and information, and also point out the necessity for giving wholehearted support to the various egg circles.

Short Courses at Potchefstroom School of Agriculture.

At the Potchefstroom School of Agriculture short courses were conducted from the 4th to and inclusive of the 15th January, 1926. Owing to the unfavourable weather conditions the number of applications received were not so great as was expected, but on the other hand the type of student was most encouraging. The applicants were mostly young farmers actually engaged in farming—a type the Schools are most anxious to see make use of the tuition and information placed at the disposal of farmers at those Institutions. The course in beef cattle and maize was held for the first time in January (instead of June as formerly), it being a more convenient period for maize and cattle farmers. The number of applications was, however, disappointing, though it is still considered that January will prove to be the most suitable season for the course.

Altogether 67 men and 33 women attended these short courses, which consisted of one each in sheep and wool; maize, summer cereals and beef; and domestic science.

INQUIRIES AND REPLIES.

SELECTED LETTERS FROM FARMERS.

[Hereunder are a number of recent letters replied to by the various Divisions and Schools of Agriculture concerned. They are selected for publication as being of interest to farmers generally in the localities affected. In each case the area only from which the inquiry emanates is given; as the replies must necessarily be curtailed, they will indicate, when required, literature from which further information may be had. All departmental bulletins quoted are obtainable on application to the Editor.]

Pip in Chickens.

Kaffir River, Orange Free State.—My fowls are suffering from what is known as pip. Kindly give me the cause and cure for same.

Glen School of Agriculture replies: Pip is nothing more than the hardening of the skin on the tip of the tongue, caused by the bird breathing through the mouth instead of the nostrils. This would happen when the nostrils are closed, due to a cold or wet mash adhering to them. Ultimately the bird dies from starvation due to to the inability to pick up food. To cure, first remove the cause. If the bird has a cold, cleanse daily its head, mouth, and nostrils with either salt water, diluted Kerol, or copper sulphate, and remove the bird to a warm, sheltered, dry coop. Soften the tongue by applying glycerine, and remove pip or horny structure on tongue when soft. Feed liberally on bread and milk.

Stock-proof Gate across a Spruit.

Hoopstad, Orange Free State.—I am troubled by cattle gaining access to my lands through a gap in a fence caused by floods damaging the fence where it crosses a spruit seven feet in width. Can I be advised of a cheap method to enable me to surmount this difficulty?

Glen School of Agriculture replies: Procure a piece of old piping or boiler tubing, or a good stout round pole of sufficient length to enable it to be bolted to the two fence-posts adjacent to the spruit. Before fixing this pipe or pole to the fence posts, obtain three pieces of chain long enough to extend from points in line with the top of the fence-poles to points vertically below about two feet from the bed of the spruit. Now make an iron ring about two inches larger in diameter than the piping or pole, but, before making the weld necessary to complete this ring, insert the round iron of which the ring is to be made through the end link of one piece of chain. Attach similar rings to the ends of the two remaining pieces of chain.

A door or gate is now constructed from any old wood, and shaped to the same shape as the spruit, leaving a space of about one foot between the sides and bottom of the spruit and the gate. Care should be taken not to make the gate too heavy. The chains are now attached to the gate and the rings slipped over the pipe or pole when the arrangement is ready to fix in position. The pipe or pole is then attached to the fence-posts with the door hanging in position to make the fence stock-proof, since when the spruit is full the gate will be forced open by the water, and when the flood subsides the gate will close automatically. To prevent erosion it may be advisable to stone-pitch the sides of the spruit below the fence.

Feeding of Bacon Pigs.

Ladybrand, Orange Free State.—I have several young sows from 120-140 pounds in weight. These are not growing, and they want the boar. As you know, bacon factories require them from 160-200 pounds in weight to obtain the highest price per pound. Should I have these sows bred? Please advise me as to the feeding of these pigs. I have plenty of mealies and green rye, but no milk.

Glen School of Agriculture replies: The pigs are, of course, under weight as far as the bacon market is concerned, and it will take some time before they reach the desired weight if they are getting nothing but mealies and green rye. These feeds alone are not satisfactory for young growing pigs, and since you have no milk it is suggested adding about 10 per cent. of meat-meal to the mealies. If any sows arrive at the market and they are visibly in pig, the buyers will naturally make allowance for this, and you will not get top prices for the pigs. So, if you want the best prices, it will be advisable not to have the sows served; but if you prefer it otherwise, it should not be done until shortly before the pigs are marketed.

Anthracnose in Vine.

George, Cape Province.—Please advise me regarding the specimen of vine forwarded for diagnosis of disease:—

Elsenburg School of Agriculture replies: The disease is diagnosed as Anthracnose. Treatment consists in a winter application (about August) of one of the following mixtures:—(1) 1 gallon sulphuric acid, 10 gallons water. (*N.B.*—The acid must be added slowly to the water, not vice versa.) (2) 5 lb. ferrous sulphate, ½ pint sulphuric acid, 1 gallon water.

This mixture is swabbed over the vines after pruning. If the stems are badly scarred, burn all the prunings. As it is too late to do this now, it is suggested that bordeaux mixture of the 4-4-50 strength be used. If you have only a few vines you might buy bordeaux powder, which simply requires the addition of water. Sulphuring will have little or no effect, and is only recommended for the control of oidium in vines.

Cracking of Sweet Potatoes.

Swellendam, Cape Province.—Would you please inform me of the cause of the cracking of my sweet potatoes?

Elsenburg School of Agriculture replies: The cracking may be due to several causes. The chief reason probably is that the fertilizer was applied in too large a quantity in one spot near the plants, thus forcing them too rapidly in a ground that at one time or another during the growing period set very hard near the surface, owing to a heavy rainfall shortly after planting, or to the interval between irrigations being too long. The best practice is to apply the soluble fertilizers broadcast over the soil before the last ploughing, disking, or harrowing so as to get it well mixed with the soil.

You are advised to plough now your ground intended for potatoes and let it lie over in a rough state until August. Horse-dropping or farmyard manure should be applied to the soil now and ploughed under so as to enable it to rot and get thoroughly mixed with the soil before the potatoes are planted in August. Use the following fertilizers in your soil for potatoes:—Government guano, 100 lb.; bone-dust, 125 lb.; superphosphate, 125 lb.; muriate of potash, 60 lb.

Dehorning of Calves.

Marico.—Kindly advise me as to the best method of dehorning calves?

Division of Veterinary Education and Research replies: The underlying idea is to prevent the growth of horns by destroying the horn-buds. This being so, the operation must be carried out while the calf is still very young, within a week after its birth. At this stage the horn-bud may be felt as a small button embedded in the skin.

For the purpose of destroying the horn-bud a caustic agent, such as caustic soda or caustic potash, is employed. Either of these agents, in the form of sticks about the thickness of an ordinary lead-pencil, and 5 inches long, is procurable from any chemist. These sticks, being caustic, should be handled with great care; they should be wrapped in a piece of paper to protect the hands and fingers, one end being left uncovered.

The calf is prepared by clipping the hair on the skin overlying the horn-buds, washing the clipped areas thoroughly with soap and warm water, and drying with a cloth or towel. A solution of ammonia in water may be used for removing the oily secretion and cleaning the skin.

The actual operation is then carried out as follows:—The uncovered end of the stick is moistened slightly and then rubbed over the entire surface of skin in which the bud is situated. First one horn-bud is treated and then the other, and the application is repeated two or three times on each. Care should be taken to apply the caustic to the horn-bud only and not to have too much moisture on the stick, since otherwise the skin in other parts may be damaged.

After treatment the calf should be protected from rain, since water on the head after application of the caustic will cause it to run down the face.

Pineapple Jelly.

Piquetberg.—How can I make jelly from pineapples? Why is it that some fruits never jell?

Elsenburg School of Agriculture replies: In the making of jelly from pineapples or any other fruit which is lacking in pectin (the jellying quality), fruits such as apples, quinces, oranges, lemons, or guavas (which have pectin) should be used in conjunction with them. When ripening, fruits contain more pectin than when fully ripe; it therefore follows that jellies and marmalades, if not made early in the season, lose a great deal of their jellying qualities. Pectin can be made to keep any length of time and used with any fruit which is required to jell. It is made as follows:—½ lb. white portion of orange peel, 3 tablespoons lemon juice, 6 cups cold water.

Scrape or grate the yellow from the peel of the orange. Remove the remaining white portion and pass it through a food chopper. Weigh, and for each ½ lb. allow 3 cups of the water and 3 tablespoons lemon juice. Mix thoroughly, allow to stand for 4 or 5 hours, then boil for ten minutes, and allow to cool. Add another 3 cups water. Bring to the boil again, and allow to stand overnight. Boil for 5 minutes again and allow to cool. Place in a flannel bag and remove all the juice by squeezing. Filter it through a clean jelly bag. Do not press the second time. If pectin is to be kept, pour the liquid into clean jars and sterilize for half an hour at boiling-point.

When using this with pineapple, add it to the extracted juice in the proportion of 1 tablespoon to a quart of juice.

"Jerusalem Artichokes."

Middelburg, Cape.—Kindly inform me whether Jerusalem artichokes should be lifted and stored when the tops die, or should they be left in the ground and dug out as required?

Grootfontein School of Agriculture replies: Jerusalem artichokes should be left in the ground, and forked out when required for use. They should remain in good condition in the ground until towards the end of the winter, when growth commences.

Rearing of Ostrich Chicks.

Oudtshoorn.—Why do ostrich chicks, about nine months old, peck out their own, and one another's feathers?

Grootfontein School of Agriculture replies: Ostriches develop the habit of feather-picking almost invariably when the birds are closely confined and food is plentiful. All observations point to the belief that it is simply a bad habit induced through idleness. The most effective remedy is to turn the ostriches out on the veld and make them hunt for their food. The effect will be noticeable within a couple of weeks. The bird's time will then be fully occupied in looking about for food, and the bad habit engendered by former easy conditions soon forgotten.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Gazette*:—

(Abbreviations: "Proc."-Proclamation. "G.N."-Government Notice.)

Gazette. *No.*	*Date.*	*Items.*
		Crown Lands for Disposal.—The following pieces of Crown lands will be offered for sale by public auction at the places and times specified:—
1525	15/1/26	(*a*) The farm Bulshoek, in extent 127 morgen, situated in the Division of Clanwilliam, Cape, in front of the Court-house at Clanwilliam on the 3rd April, 1926. (G.N. No. 75.)
1530	5/2/26	(*b*) The farms Achterste Fontein Heights, Bakkrans, Brandhoek, Klipbakken, Matjeskloof, Verzien, Vyfhoek, Wildehondskloof, and Swart Scheur, Clanwilliam District, Cape, in front of the Court-house at Clanwilliam on the 3rd April, 1926. (G.N. No. 219.)
1530	5/2/26	(*c*) Lots Nos. 4, 5, 6, 7, 8, and 9, of Oakdale Estate, Division of Riversdale, Cape, at the residence of Mr. F. van der Vyver, superintendent of Oakdale and Novo Settlements, on the 27th of March, 1926. (G.N. No. 229.)
1529	29/1/26	Applications will be received at the Department of Lands, Pretoria, for the lease of certain farms in Bloemfontein and Boshof Districts, Orange Free State. (G.N. No. 190.)
1530	5/2/26	Also for certain farms in the Lydenburg, Zoutpansberg, Johannesburg, Pretoria, Rustenburg, and Standerton Districts, Transvaal. (G.N. No. 200.)
		Dipping.—The compulsory dipping of sheep and goats has been ordered as follows:—
1528	22/1/26	(*a*) On the farms Stormfontein and Droogefontein, Wodehouse District, between the 1st January and the 31st March, 1926. (G.N. No. 99.)
1529	29/1/26	(*b*) In the Districts of Prieska, Hopetown, Herbert, Kimberley, and Barkly West, Cape, during the period 1st March and 30th April, 1926. (G.N. No. 140.)
		The compulsory dipping of cattle has been ordered as follows:—
1528	22/1/26	Every fourteen days in the fourteen-day dip on (*a*) the farms Syde No. 245, The Chime No. 246, Dingleside No. 244, Lions Glen No. 81, Stafford No. 83, Glen Aggy No. 84 De Hoop No. 257, Nerston No. 256, Sandback No. 82, Amsterdam Town, Tweepoort No. 49, Avoca No. 258, Merriekloof No. 259, Enhlovudwalile No. 260, Sarashof No. 286, Paardenkraal No. 290, Samlee No. 289, Athole No. 85, Glen Eland No. 21, Geduld No. 291, Kolwani No. 293. Timbana No. 292. Bushmanspruit No. 295, Zandspruit No. 103, and Koksdal No. 296, Ermelo District, Transvaal (G.N. No. 126);
1529	29/1/26	(*b*) the farms Vlakfontein No. 46, Klipplaatdrift No. 47, Holnek No. 41, Welgevonden No. 166, Klein Theespruit West No. 112, Jagtlust No. 64, Kleinbuffelspruit No. 111, and Heerenveen No. 114, Carolina District, Transvaal. (G.N. No. 175.)

1529 29/1/26 Every seven days in the seven-day dip on (*a*) certain farms in the Carolina District, Transvaal (G.N. No. 175);
1530 5/2/26 (*b*) certain farms in the Pietersburg District, Transvaal. (G.N. No. 220.)

1530 5/2/26 Every five days in the five-day dipping-fluid on (*a*) Zwelonkwe's Cattle Dipping-tank Area, Umzimkulu District, Transkei; (*b*) certain farms in the Pietersburg District, Transvaal. (G.N. No. 220.)

1528 22/1/26 *Plant Diseases.*—With a view to preventing the spread of *wart disease in potatoes*, the following farms have been declared to be restricted areas: Vogelstruisfontein No. 62 and Witpoortje No. 44, District Krugersdorp, Transvaal. (Proc. No. 14.)

Regulations with regard to the above are scheduled in Government Notice No. 129.

1529 29/1/26 *Fencing.*—Contributions towards the cost of dividing fences have been declared obligatory as follows:—

(*a*) On certain farms in the Division of Calvinia, Cape. (Proc. No. 20.)
(*b*) In Wards Elands River and Rhenosterkop, Pretoria District, Transvaal. (Proc. No. 21.)
(*c*) In Ward No. 3, Komati River. District Carolina, Transvaal. (Proc. No. 22.)

1530 5/2/26 For the purpose of obtaining repayment of the advance (and payment of interest thereon) which has been made by the Government for the erection of a dividing fence between the farm Jackhalsfontein and Locations Nos. 1, 2, 3, 4, 5, and 6, Herbert District, a levy has been imposed on and shall be collected from each adult male inhabitant of the above farm and locations. (Proc. No. 27.)

STAFF: APPOINTMENTS, CHANGES, ETC.

9/11/25 *D. G. Steyn, B.Sc., Dr.Med.Vet.*, appointed Veterinary Research Officer, Veterinary Education and Research Laboratory, Allerton.

1/1/26 *N. van Dalsen*, First-grade Inspector of Co-operative Societies, Division of Co-operation, Pretoria, promoted to Senior-grade Inspector of Co-operative Societies, Division of Co-operation, Pretoria.

4/1/26 *I. S. Fourie, B.A.(S.A.), B.A. (Honours, Oxford)*, appointed Second-grade Economist, Division of Economics and Markets, Pretoria.

4/1/26 *M. C. Mossop, B.Sc., M.Sc.*, appointed Entomologist, Division of Entomology, Pretoria.

7/1/26 *V. A. Wager*, appointed Lecturer in Botany, Glen School of Agriculture.

20/1/26 *W. Rode, B.A., LL.B.*, appointed First-grade Inspector of Co-operative Societies in Division of Co-operation, Pretoria.

20/1/26 *A. W. O. Bock, B.Com.*, appointed Second-grade Inspector of Co-operative Societies in Division of Co-operation, Pretoria.

NOTICE.

"FARMING IN SOUTH AFRICA."

The Department's monthly *Journal* will be issued under the above title from April, 1926, onwards. Present subscribers to the *Journal* will receive *Farming in South Africa* unless the Government Printer, Pretoria, is advised to the contrary. This publication will contain concise, practical notes, articles, etc., being information that the Department of Agriculture wishes to bring before the farmer.

IMPORTANT.

Apply at once to the Government Printer, Pretoria, sending 5s. for a year's subscription to

"FARMING IN SOUTH AFRICA."

and secure from the beginning the publication that will keep you in close touch with *your* Department.

JOURNAL OF THE DEPARTMENT OF AGRICULTURE.

VOL. XII. JUNE, 1926. No. 4.

Published quarterly in English and Afrikaans by the Department of Agriculture Union of South Africa.

SUBSCRIPTION: Within the Union and South-West Africa, **5s.** (otherwise **6s.**) per annum, post free, payable in advance.

Applications, with subscriptions, to be sent to the Government Printer, Pretoria.

NOTES.

The Quarterly Journal.

THE *Journal of the Department of Agriculture* started publication in April, 1920, since when it appeared monthly until and including the March, 1926, number (Vol. XII, No. 3). After that issue it was decided to publish the *Journal* quarterly instead of monthly, and the present is the first number in its quarterly form (Vol. XII, No. 4). The *Journal* will continue to publish articles of the same nature (and possibly others of a more technical nature) as in the past, but the notes, under the titles of "Departmental Activities" and "Inquiries and Replies," will not be included.

In the place of the *Journal*, the monthly publication *Farming in South Africa* was started in April, 1926. Its purpose is to publish short articles and notes that will appeal to the farmer. In it will appear the notes, referred to above, that formerly were in the *Journal*, together with summaries of articles published in the quarterly *Journal*, and other features.

The subscription for each of these publications is 5s. per annum, post free, to residents in the Union and South-West Africa; otherwise 6s. Remittance, with name and address, should be sent to the Government Printer, Pretoria.

Index to the "Journal."

The index of Volume XI (July to December, 1925) of the *Journal of the Department of Agriculture* is now ready, and those requiring a copy thereof are requested kindly to apply for one to the Government Printer, Pretoria, when it will be supplied free of charge.

The next volume of the *Journal* will comprise the monthly issues for January, February, and March, 1926, and the quarterly ones for June, September, and December, 1926. An index for this volume will in due course be prepared on the same lines as past ones, and be supplied free of charge to applicants.

The Genera of South African Flowering Plants.

Students of South African botany will welcome the coming publication of a convenient handbook on the South African Flowering Plants, which is now in the printer's hands. It is compiled by E. P. Phillips, M.A., D.Sc., F.R.S.S.Afr., Senior Botanist, Division of Botany, and will be Memoir No. 10 of the Botanical Survey of South Africa.

Since the year 1868, when the late Sir Joseph Hooker published the second edition of Harvey's "Genera of South African Plants," a great need has been felt for a similar work brought up to date. Since that time the exploration of the South African flora has made tremendous strides, especially in Natal, the Transvaal, and South-West Africa, which at that period were almost *terrae incognitae*, but even in the Cape Province many new genera have been found, and others have become better known or have been remodelled. Dr. Phillips's book will therefore be a great boon to all botanical workers in South Africa, even if they have large libraries at their disposal. It will also be of great assistance to teachers in secondary schools and to students of our universities, as well as to officers in Government Departments.

To these the elaborate keys which have been constructed with minute care, and have, as far as possible, been repeatedly tested, should be particularly welcome. We expect that Dr. Phillips's work will act as a great stimulus to advance the study of our immensely varied flora.

The book, which will consist of between 500-600 pages of description and keys, will be sold at £1 per copy. Orders may now be placed with the Government Printer, Pretoria, or the Superintendent, Government Printing and Stationery Office, Capetown.

STUDIES IN THE COST OF PRODUCTION OF BACON AT THE CEDARA SCHOOL OF AGRICULTURE.

(Under the Direction of the Division of Field and Animal Husbandry.)

I.

By A. E. ROMYN, Ph.D., M.Sc., B.Sc.(Agric.), and
H. J. VAN DER MERWE, M.Sc.

SINCE March, 1924, a number of experiments on various local problems in connexion with the production of baconers have been in progress at the School of Agriculture, Cedara.

An interim report on some phases of this work is presented here. The data here given cover—

(1) the effect of the age at weaning on the subsequent growth of the pig;

(2) (*a*) the feed cost of gains in live-weight on various rations from the weaner to the finished baconer stage;

(*b*) the total feed cost of eighty-six baconers for the same period;

(3) the use of self-feeders;

(4) the quality of carcass produced by the systems of feeding followed in these experiments.

EFFECT OF AGE AT WEANING ON THE SUBSEQUENT GROWTH OF THE PIG.

General Outline.—Young pigs are generally weaned at from eight to twelve weeks. There is some difference of opinion as to what age is the best for weaning. The optimum age, naturally, will depend on the conditions under which the weaners have subsequently to grow. To determine the most suitable age under conditions where a regular supply of green feed is available throughout the feeding period, and where there is a fair supply of separated milk as well for at least the first three or four weeks after weaning, a number of records were taken on seventy-one weaners utilized in the feeding experiments described in this report.

The experiments were divided into two sets of trials which commenced on the 24th August, 1924, and the 4th May, 1925, respectively.

Trial No. 1—Description of Pigs.—In this trial thirty-one cross-bred Berkshire × Large Black pigs were weaned at twelve, ten, nine, and eight weeks of age. The pigs were completely weaned at one operation. They were then divided for other experimental purposes into four feeding lots. Data, however, are available on the age at which each individual pig reached 180 lb. live-weight. It is possible therefore to determine fairly well what effect the age of weaning has had on the pig's subsequent growth.

Description of System of Feeding.—The four lots were fed on the following systems:—

Lot I.—Stye-fed.
Lot II.—Self-feeder on Kikuyu pasture.
Lot III.—Limited grain ration on Kikuyu pasture.
Lot IV.—Full grain ration on Kikuyu pasture.

The stye-fed pigs were given cut Kikuyu grass as a substitute for pasture. Lots I, III, and IV were fed separated milk throughout. Lot II was only given separated milk for three weeks after weaning.

The average ages at which the pigs of the different weaning ages reached 180 lb. live-weight are given in Table I.

In Lots I, III, and IV there was no significant difference between the ages at which the pigs of the different weanings reached 180 lb. In the self-feeder lot, however, the eight and nine weeks' weaning did not do so well as the later weanings. The number of pigs involved seems too small to justify the inclusion of all this rather cumbersome data, and, therefore, only the average figures of all the pigs of the one age are shown here.

Trial No. 2.—Description of Pigs.—Forty cross-bred Berkshire × Large Black pigs, weaned at the ages of eleven, nine, and eight weeks, were used for this trial.

Description of Feeding System.—The pigs were then divided for other experimental purposes into four lots and fed on the following systems:—

(*a*) Stye-fed.
(*b*) Self-feeder in dry lot.
(*c*) Self-feeder in dry lot.
(*d*) Hand-fed in dry lot.

All lots were given a ration of separated milk for three weeks after weaning. Subsequent to this, only the stye-fed lot received separated milk. All the pigs were given a liberal supply of green feed in the form of rape, kale, or chou moellier. The pigs were marketed at 185 lb. live-weight, as compared with the 180 lb. of the first trial. Similar data to that obtained in Trial No. 1 are available on these pigs.

In this trial in each lot, including the self-feeder lot, the pigs of the different weaning ages reached 185 lb. at the same age.

TABLE I.

Age at which 180 or 185 lb. Live-weight was Reached by Different Weanings.

Trial No. 1.

Number of Pigs.*	Age at Weaning in Weeks.	Age at which 180 lb.† was Reached in Days.
8	12	183
10	10	181
7	9	191
6	8	182

* There were 40 pigs in these trials, but data are only available on 31.
† When any pig was over 180 or 185 lb. in weight at the time of weighing, a correction, based on the individual rate of gain for the previous few days, was made.

Trial No. 2.

Number of Pigs.	Age at Weaning in Weeks.	Age at which 185 lb. was Reached in Days.
17	11	181
8	9	185
15	8	181

Discussion of Results.—It appears from Table I that in these experiments the age of weaning has made no significant difference to the time at which 180 lb. or 185 lb. live-weight was reached.

These results are somewhat more significant than may appear on the surface, because the practice followed in this experiment of mixing weaners of different ages in the same feeding lot is not to be recommended.

Breeding Sows on Pasture.

Despite the fact that plenty of trough-room was provided, the younger pigs were considerably handicapped by competition with the older ones. The older pigs were constantly removed as they reached the weights of 180 and 185 lb. This tended to minimize the handicap; yet, despite their disadvantage, the younger weaners were finished off at the same age as the older ones.

Conclusions.—(*a*) In these trials the pigs weaned at eight weeks have done as well as those weaned at twelve weeks, or at ages between twelve and eight weeks.

(*b*) Since an eight weeks' weaning gives a greater use of the sow, it seems to be the most suitable weaning age of those tried.

FEED COST OF THE GAINS MADE FROM THE WEANER STAGE TO THE FINISHED BACONER.

In this section are summarized the results of two trials.

Trial No. 1 commenced on the 24th August, 1924.

Trial No. 2 commenced on the 4th May, 1925.

Trial No. 1 therefore covers a period of summer feeding and Trial No. 2 one of winter feeding.

Description of Pigs Used.—The pigs used in both trials were cross-bred Berkshire x Large Blacks, which varied from eight to twelve weeks of age at the commencement of the experiment in Trial No. 1, and from eleven to fourteen weeks of age in Trial No. 2.

Description of System of Feeding.—Unless otherwise stated, the hand-fed pigs were fed as much grain as they would clean up within about twenty minutes from the time of feeding.

When the pigs were not on pasture, green feed was given twice daily in as large quantities as the pigs would reasonably clean up.

The green feed in Trial No. 1 consisted of either Kikuyu pasture or of cut Kikuyu grass fed as a soiling crop.

In Trial No. 2 rape, kale, and chou moellier were used as green feed in the sequence named.

The concentrated feeds used were of the average commercial quality. The maize was whole yellow maize, Grade No. 2. The rations used in the different lots are described in Table II.

TABLE II.

Combinations of Feeds used in the Various Rations.

Trial No. 1.

Lot I.	Lot II.	Lot III.
Stye, Full grain ration, Whole maize, Separated milk, Bone and meat meal, Kikuyu grass.	Pasture, Full grain ration, Whole maize, Separated milk, Bone and meat meal, Kikuyu pasture.	Pasture, Limited grain ration. Whole maize, Separated milk, Bone and meat meal, Kikuyu pasture.

Trial No. 2.

Lot I.	Lot II.	Lot III.	Lot IV.
Stye, Full grain ration, Whole maize, Separated milk, Bone and meal meal, Blood-meal, — Green feed.	Dry lot, Self-feeder, Whole maize, — Bone and meat meal, Blood-meal, — Green feed.	Dry lot, Self-feeder, Whole maize, — Bone and meat meal, — Peanut-cake meal, Green feed	Dry lot, Full grain ration, Whole maize, — Bone and meat meal, Blood-meal, Peanut-cake meal, Green feed.

The proportions in which these different feeds were fed were varied during the experiment. The average proportions for the whole feeding period are given in Table III.

TABLE III.

Average Proportion by Weight in which the Various Rations were Fed.

Trial No. 1.

Feed.	System of Feeding.		
	Stye-fed.	Limited Grain Ration.	Full Grain Ration.
Whole maize	25·6 lb.	26·5 lb.	28·2 lb.
Separated milk	4·3 gallons	3·7 gallons	4·1 gallons
Bone and meat meal ...	1·1 lb.	1·5 lb.	1·4 lb.

Trial No. 2.

Feed.	System of Feeding.			
	Stye-fed.	Self-feeder. Blood-meal.	Self-feeder. Peanut-cake Meal	Hand-fed Check Lot.
Whole maize	55·6 lb.	43·0 lb.	18·6 lb.	36·2 lb.
Separated milk ...	9·3 gallons	—		—
Bone and meat meal ...	2·5 lb.	1·0 lb.	1·0 lb.	1·2 lb.
Blood meal	1·0 lb.	5·4 lb.	—	1·0 lb.
Peanut-cake meal ...	—	—	6·0 lb.	2·7 lb.

System of Records.—All the feed used was weighed. The pigs were weighed every two weeks from the commencement of the experiment, and at shorter intervals as they approached market weights.

The pigs were marketed at approximately 180 lb. live-weight in Trial No. 1 and 185 lb. in Trial No. 2.

Whenever a sufficient number of pigs reached these weights they were dispatched to the bacon factory and the necessary adjustments made in the feed and experimental records.

Tables IV and V show the amounts of feed consumed and the cost of such feeds.

TABLE IV.

Feed Cost of Gains from the Weaner Stage to the Finished Baconer.

Trial No. 1.

Lot.	System of Feeding.	Number of Pigs.	Weights.				Total Feed Consumed				Feed Consumed per 100 lb. Gain in Live-weight.				Cost of Gain per lb.
			Average Daily Gain	Initial Weight	Final Weight.	Total Gain in Weight.	Maize.	Separated Milk.	Bone and Meat Meal.	Green Feed.	Maize.	Separated Milk.	Bone and Meat Meal.	Green Feed.	
			lb.	lb.	lb.	lb.	lb.	gal.	lb.	lb.	lb.	gal.	lb.	lb.	pence.
I	Stye	9	1·36	385*	1,671	1,286	3,296	550	146	355	256·3	42·8	11·3	27·6 equals ·046 acres	3·33
II	Full grain ration on pasture	9	1·32	357*	1,660	1,303	3,704	538	182	½ acre	284·2	41·3	13·9	·038 acres	3·55
III	Limited grain ration on pasture	10	1·06	449	1,788	1,339	3,555	497	197	1 acre	265·5	37·1	14·7	·075 acres	3·33

* The necessary allowance has been made for one pig which died in each of these lots.

Prevailing costs of the feeds used—

Maize 7s. 6d. per 100 lb.
Bone and meat meal 8s. per 100 lb.
Separated milk, 2d. per gallon
Kikuyu pasture £1 per acre per year

TABLE V.

Feed Cost of Gains from the Weaner Stage to the Finished Baconer.

Trial No. 2.

Lot.	System of Feeding.	Number of Pigs.	Weights. Average Daily Gain.	Initial Weight.	Final Weight.	Total Gain in Weight.	Total Feed Consumed. Maize.	Bone and Meat Meal.	Blood meal	Peanut-cake Meal.	Separated Milk.	Green Feed.	Feed Consumed per 100 lb. Gain in Live-weight. Maize.	Bone and Meat Meal.	Blood-Meal.	Peanut-cake Meal.	Separated Milk.	Green Feed.	Cost per lb. of Gain.
			lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	gal.	lb.	lb.	lb.	lb.	lb.	gal.	lb.	pence.
I	Stye	10	1·34	526	1,966	1,440	3,448	153	62	—	578	2,727	239·5	10·6	4·3	—	40·1	189·3	2·64
II	Self-feeder, Blood-meal...	10	1·79	537	1,974	1,437	4,218	98	528			1,664	293·5	6·8	36·7	—	—	115·8	2·53
III	Self-feeder. Peanut-cake Meal	10	1·61	513	1,954	1,441	3,562	191	—	1,146		1,778	247·2	13·2	—	79·5	—	123·4	2·82
IV	Hand-fed check	10	1·28	511	1,976	1,465	3,841	132	106	291		3,346	262·2	9·0	7·2	19·9	—	228·4	2·29

Prevailing cost of the feeds used:

Whole maize, 5s. 6d. per 100 lb.
Bone and meat meal, 7s. 6d. per 100 lb.
Blood-meal, 10s. 6d. per 100 lb.
Peanut-cake meal, 10s. 6d. per 100 lb.
Separated milk, 2d. per gallon.
Green feed, 10s. per 2,000 lb.

Discussion of Results.—The feeds used were such as are generally available to the Natal farmer, and have been balanced according to the usual methods. On these rations the pigs seemed to have made satisfactory and economical gains.

In Trial No. 1, at the prevailing prices for feeds, the average cost of gain in live-weight was 3·4d. per lb.

In Trial No. 2, with a somewhat lower price of maize, the average price was 2·6d. per lb. These costs do not, of course, include the cost of the weaner.

In Trial No. 1 the Kikuyu pasture proved a very satisfactory feed. The pigs relished the grass, but were not able to keep it down.

The figures given for pasture could, consequently, have been reduced if smaller areas had been used to start with.

Except for the stye-fed lots, the two trials are not directly comparable. Trial No. 1 took place in the summer on pasture, whereas Trial No. 2 covers a period of winter feeding in dry lot.

The two stye-fed lots, however, show close agreement, and the figures for the consumption of feed by these lots may be taken as fairly representative of what can be expected under conditions such as obtained in this experiment.

The Total Feed Consumed and the Feed Cost of all the Pigs.—During Trial No. 1 sixteen pigs were on hand, which do not figure in the three experiments reported here. Fourteen of these pigs were finished for market and records kept on the feed consumed in the same way as for the experimental lots. They were, as it turned out, finished at a lower cost than the experiment pigs. Two pigs died during Trial No. 1. The total feed consumed by the forty-six pigs in Trial No. 1 and forty pigs in Trial No. 2 is given in Table VI. These figures are inclusive of the deaths in Trial No. 1 and the preliminary feeding period of Trial No. 2. They are therefore different from those in Tables IV and V. They include all the feed consumed from the day of weaning until market-weights were reached.

Despite the handicap of the loss of two young pigs in Trial No. 1, the feed costs of the two trials work out at approximately the same, viz., 3·18d. and 3·06d. per lb.

Conclusions.—(1) The average feed costs per lb. of grain for all the experimental lots from weaner to bacon stage worked out at 3·4d. per lb. in Trial No. 1 and 2·6d. per lb. in Trial No. 2.

TABLE VI.

The Total Amount of Feed, the Amount of Feed Used to Produce 100 lb. Gain of Live-weight, and the Cost of the Combined Four Lots in each of the Two Trials.

Trial.	Number of Pigs Fed.	Number of Pigs Marketed.	Total Weight of Bacon Produced.	Total Amount of Feed Consumed.							Amount of Feed Consumed per 100 lb.							* Cost of Feed per lb. Gain in Live-weight.
				Maize.	Bone and Meat Meal	Blood-meal	Separated Milk.	Peanut-cake Meal.	Pollard.	Green Feed	Maize.	Meat-meal.	Blood-meal	Separated Milk.	Peanut-cake Meal.	Pollard.	Green Feed.	
				lb.	lb.	lb.	gal.	lb.	lb.	lb.	lb.	lb.	lb.	gal.	lb.	lb		pence.
I	46	44	5,855	15,705	784	—	1,756	—	—	Pasture 3 acres 4 months	268	13·4	—	30	—	—	Kikuyu pasture ·05 acres	3·18
II	40	40	5,383	16,411	626	896	754	1,437	120	8,515 lb.	304·8	11·6	16·6	14	26·7	2·2	158 lb. green feed	3·06

* For the cost of feed see Tables IV and V.

(2) The total feed costs of all the pigs in the trials, including losses and certain pigs not appearing in the experiments reported on in Trial No. 1, amounted to—

Trial No. 1.—3·18d. per lb.
Trial No. 2.—3·06d. per lb.

THE USE OF SELF-FEEDERS.

General Outline.—The use of self-feeders has been advocated in South Africa on account of the inefficiency of native labour. It is generally acknowledged that this system is not so economical of feed as that of hand-feeding, but the certainty that the pigs have a sufficient supply of the proper feeds always available is said to compensate for the possibly less economical gains.

Description of Pigs.—Thirty Berkshire × Large Black pigs—eleven to fourteen weeks old—were used in this trial. These pigs were weaned at eight to eleven weeks. After weaning they were all fed on a ration of maize, pollard, separated milk, and green feed for a preliminary feeding period of three weeks before the experiment proper was commenced.

Description of Feeding System.—It was originally planned to use only a ration of whole maize and bone and meat meal fed in separate compartments of a self-feeder. Earlier trials have indicated, however, that bone and meat meal is an unpalatable feed, and that pigs, where given free choice, will not eat sufficient of this feed to balance a maize ration. It was decided therefore to adhere to a basal ration of maize and bone and meat meal, but to supplement the bone and meat meal by, in the one case, an animal protein such as blood-meal, and in the other by a vegetable protein, such as peanut-cake meal.

The pigs were divided into three lots of ten pigs each. Each lot had the run of a dry lot of half an acre in extent. As much green feed in the form of rape, kale, and chou moellier as the pigs would consume was provided twice daily. The hand-fed lot was fed as much grain feed twice a day as the pigs would clean up in twenty minutes after feeding.

The other lots had the necessary grain in front of them continuously in separate compartments of a self-feeder.

The different rations used were:—

Lot 1 (self-fed).—Whole maize, bone and meat meal, blood-meal.

Lot 2 (self-fed).—Whole maize, bone and meat meal, peanut-cake meal.

Lot 3 (hand-fed).—Whole maize, bone and meat meal, peanut-cake meal, blood-meal. This lot was intended as a check on Lots 1 and 2.

System of Marketing.—The pigs were marketed at 185 lb. live-weight. Whenever a sufficient number of pigs of 185 lb. or over were available, the necessary records of weights and adjustments of feed were made and the pigs were sent to the Farmers' Co-operative Bacon Factory, Estcourt, to be killed, cured, and graded.

Table VII illustrates the feeding results of this trial

TABLE VII.

The Amount of Feed Consumed, Economy, Rate and Cost of Gains by Hand-fed and Self-f d Pigs.

Lot.	Number of Pigs.	Total. Initial Weight.	Total. Final Weight.	Total. Total Gain.	Total. Average Daily Gain	Total Feed Consumed. Maize	Total Feed Consumed. Meat-meal.	Total Feed Consumed. Blood-meal.	Total Feed Consumed. Peanut-cake Meal	Total Feed Consumed. Separated Milk	Total Feed Consumed. Green Feed.	Feed Consumed per 100 lb. Gain. Maize	Feed Consumed per 100 lb. Gain. Meat-meal.	Feed Consumed per 100 lb. Gain. Blood-meal.	Feed Consumed per 100 lb. Gain. Peanut-cake Meal.	Feed Consumed per 100 lb. Gain. Separated Milk	Feed Consumed per 100 lb. Gain. Green Feed.	Feed Cost per lb Gain
		lb	lb.	lb.	lb	lb.	lb	lb	lb.	gal.	lb	lb	lb.	lb	lb.	gal	lb.	pence.
I Self-feeder. Blood-meal	10	537	1,974	1,437	1·79	1,218	98	528	—	—	1 664	293·5	6·8	36·7	—	—	115·8	2·53
II Self-feeder, Peanut-cake Meal ...	10	513	1,954	1,441	1·61	3 562	191		1,146	—	1,778	247·2	13·2	—	79·5		123·4	2·82
III Hand-fed	10	511	1,976	1,465	1·28	3,841	132	106	291	–	3 316	262·2	9·0	7·2	19·9	—	228·4	2·29

Prices prevailing during the period of the experiment

Whole maize (yellow), 5s. 6d per 100 lb
Meat-meal, 7s 6d. per 100 lb
Blood-meal, 10s 6d. per 100 lb
Peanut-cake meal, 10s. 6d. per 100 lb.
Pollard 9s. 6d per 100 lb.
Separated milk, 2d. per gallon
Green feed, 10s per ton (2,000 lb).

Discussion of Results.—The self-feeders proved satisfactory. The amount of feed consumed per 100 lb. increase in live-weight compares quite favourably with the hand-fed lot. The self-fed pigs wasted a considerable amount of feed. Some feed was also rendered uneatable by rain beating into the self-feeder troughs. Birds also consumed a certain amount. This wastage has been included in the feed consumed, and probably accounts for the apparently greater consumption per 100 lb. increase in weight.

The self-feeder pigs gained faster than the hand-fed pigs in the dry lot, but the gains were more expensive. The extra expense was made good by the fact that the self-feeder pigs were ready for market earlier and sold at ½d. to 1d. per lb. more than the hand-fed ones, which struck a falling market. This indicates a promising use for the self-feeder in forcing pigs for an early market. The self-feeder pigs on the hoof appeared considerably more "chunky" than the hand-fed lots.

The most interesting feature of the trial is the unpalatability of the bone and meat meal. It was noticed that the bone and meat meal was very little eaten by either self-fed lot. When given free choice the pigs eat either five times as much blood-meal or six times as much peanut-cake meal as bone and meat meal.

In this trial the most expensive gains were made by the peanut-cake-meal-fed pigs. These pigs also produced the most unsatisfactory bacon. The cost and economy of gains of all lots are considered satisfactory.

Conclusions.—(1) The pigs on the self-feeders made faster but not so economical gains as the pigs which were hand-fed.

(2) The greater rate of gain in the self-feeder pigs enabled them to be marketed at a higher price than the hand-fed ones—they consequently returned a greater profit.

(3) If speed in marketing is desired, the self-feeder system may be a desirable form of feeding.

(4) On account of its unpalatability, bone and meat meal alone is not a satisfactory feed for use in a self-feeder.

The first three conclusions have been frequently substantiated by work in the United States of America

QUALITY OF CARCASS.

The pigs in Trial No. 1 were sent to the Nelsrust Bacon Factory for slaughter. A proportion of the sides were shipped after curing to the South African Trade Commissioner in London for report.

The pigs in Trial No 2 were sent to the the Farmers' Co-operative Bacon Factory, Estcourt, for slaughter, and a proportion of the sides was subsequently dispatched to Messrs. Thrupps & Company, Johannesburg, for a similar report.

In both cases the quality of the carcasses proved unsatisfactory. The factory reports show that the carcasses were of an average quality, but in both cases the wholesalers' report stated that the sides were too short, fat, and soft.

The pigs were sold on the hoof for the highest price obtainable at the time of sale, and on both lots good profits were realized.

From the standpoint of immediate profit, the system of feeding would seem to have been a success, but, from the standpoint of the production of bacon for export, it has certainly been a failure.

These preliminary results are disquieting. The pigs used were a good type, both boar and sows are from prize-winning strains, the feeds used are those which have perforce to form the major part of a pig ration in Natal. Yet both trials indicate that, under the conditions described, satisfactory bacon is not produced from a ration consisting mostly of maize, though well balanced in other respects.

The question now is to modify this ration with feeds which are *commonly* available in South Africa, and which will produce a firm side at a *reasonable* cost. To this end it is the intention in the next trials to modify the feeding system in two directions:—

(*a*) Lengthen the time of feeding. It was noticed that the less thrifty pigs, which finished slowest and returned the smallest net profit, were reported as making the best bacon sides.

(*b*) Altering the proportion of maize in the ration. This will be done by the use of barley and pollard, either throughout the feeding period or in the finishing period alone.

FOWL TYPHOID.

By G. MARTINAGLIA, V.S., M.Sc., B.V.Sc., Veterinary Research Officer, Pietermaritzburg, Natal.

FOWL typhoid is an acute specific disease of poultry, having the general characteristics of a septicaemia, and caused by a rod-shaped organism known as *Bacillus gallinarum*.

HISTORY OF THE DISEASE.

The disease was first noticed as far back as 1878 in northern Italy by Perroncito, the famous Italian veterinarian. He pointed out that it was a disease different from fowl cholera (a disease which it simulates very closely in many respects), but through lack of bacteriological knowledge in those days, it was not possible to affect a clear diagnosis.

This disease was first described by Klein, in Orpington, Kent, England, in 1888, under the name of " infectious enteritis" of fowls, and is still known on the Continent of Europe as Klein's disease. He was also able to isolate the causal organism, which he named *Bacillus gallinarum*.

In 1895 Moore described an infectious disease in poultry in the United States. He gave a more detailed description of the organism than Klein, and designated it *Bacterium sanguinarium*, but associated it at that time with infectious leucaemia of fowls.

Years later Hadley, of the Rhode Island Experiment Station, made a comparative study of the organism isolated by Klein and Moore respectively, and showed that those organisms were identical. Since then this disease has also received a good deal of attention by veterinary bacteriologists in Holland, France, and Belgium.

In South Africa fowl typhoid seems to have been confused in the past with fowl cholera.

In 1907 Robertson, of the Grahamstown Laboratory, reported the occurrence of a poultry disease simulating fowl cholera. The description given by Robertson points more to an atypical form of fowl cholera than fowl typhoid.

Mr. Mitchell, of the Allerton Laboratory, Pietermaritzburg, investigated many epidemics among poultry in Natal during the last three years, and never met with fowl cholera.

The writer investigated a number of epidemics among poultry in the Transvaal while working in the Onderstepoort Laboratories, Pretoria, but also failed in his search for fowl cholera.

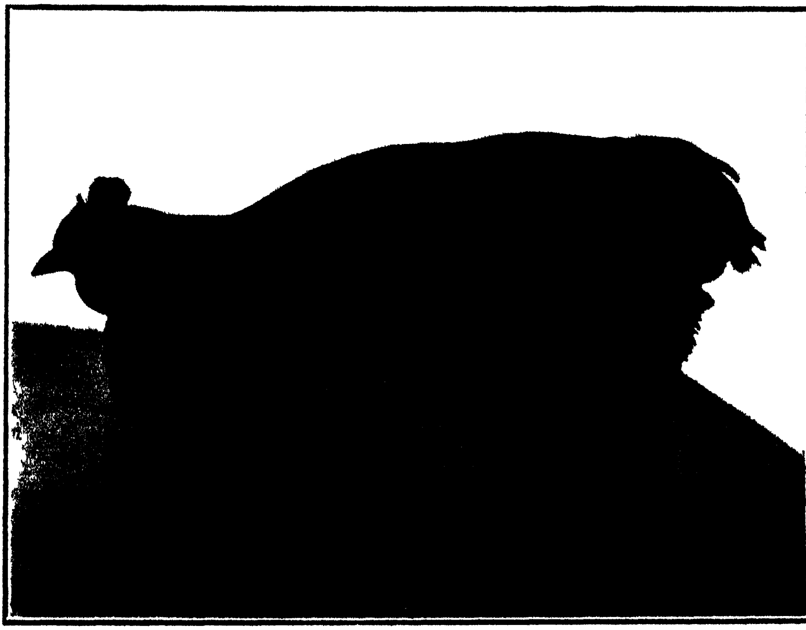
It would thus appear that the majority of epidemics of a septicaemic nature in this country are not fowl cholera as was previously surmised, but fowl typhoid.

There is no data available when fowl typhoid was first introduced into South Africa, but it looks as if the disease has been smouldering for years in this country and is on the increase at present.

Many of our poultry epidemics which we so often call fowl-sickness, liver disease, "bloukam," etc., are probably due—in the majority of cases—to fowl typhoid.

Our present knowledge of this disease in South Africa is based on the careful clinical, pathological, and bacteriological study of five epidemics occurring within a five hundred miles radius, involving the Transvaal, Natal, and East Griqualand.

The first cases diagnosed were sent from a poultry farm near Pretoria to the Onderstepoort Laboratories in November, 1924, when the owner informed us that he lost sixty fowls from a similar outbreak the previous year. During March of the following year two severe outbreaks occurred in Johannesburg on the farms of two prominent poultry breeders, whose plants are situated many miles



Bird suffering with Fowl Typhoid.
(Natural Case.)

apart. During May of the same year dead fowls were sent in from Cedarville, East Griqualand, to the Allerton Laboratory, Pietermaritzburg. The disease was recognized and bacteriologically confirmed. The owner informed us that his maximum losses were at the rate of fifteen a day During October, 1925 two live sick fowls arrived at the Laboratory from a farm near Pietermaritzburg, and the disease was diagnosed by Mr. Mitchell as fowl typhoid.

To each of the owners where the last four outbreaks occurred an autogenous vaccine was dispatched immediately after the bacteriological diagnosis was made, accompanied with instructions as regards isolation and general sanitation.

Vaccination is still in the experimental stage, but the results so far obtained have been encouraging. It seems that the epidemics were checked by the prompt vaccination of all apparently healthy birds.

All the above outbreaks were marked by extraordinary severity of infection and high mortality, except at one farm, where the owner had his fowls in separated coops.

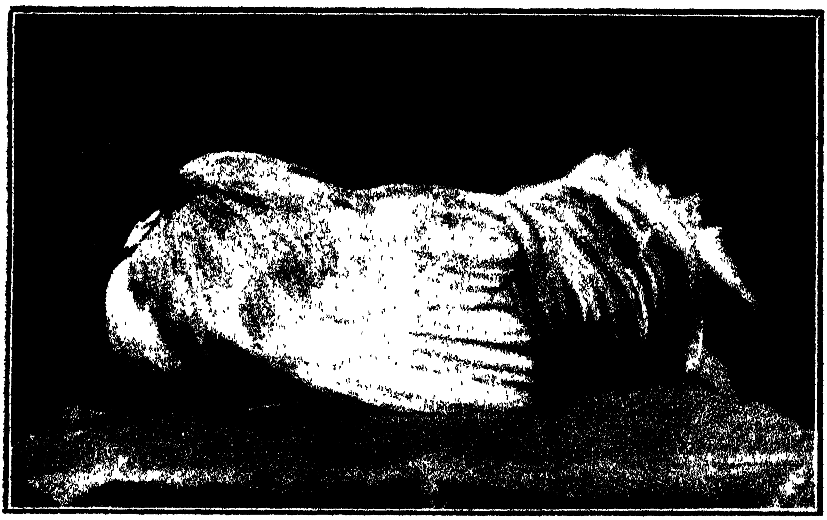
The organism causing the disease was isolated—in all cases studied—from the liver, kidneys, spleen, and blood-stream, and readily grown on the common artificial media.

The disease was reproduced again artificially by feeding the organism to healthy birds.

The incubation period of the disease in South Africa, under experimental conditions, varies from two to six days before a rise in temperature is noticeable.

SYMPTOMS OR CLINICAL FEATURES.

The symptoms are recorded as noted in South Africa, to enable poultrymen to detect the disease quickly, in order to take the necessary precautions to arrest it and prevent its spread.



Bird suffering with Fowl Typhoid.
(Experimental Case.)
Showing typical ruffling of neck feathers, drooping of wings, and head drawn closely into body.

In an avian typhoid epidemic there is generally a sudden onset of the disease. The owner loses fowls in rapid succession until the disease has run its course, the death-rate depending on the resistance of the flock as a whole and the virulence of the organisms present.

The individual sick birds show a diminished appetite, increased thirst, and general dullness. The feathers are ruffled, especially round the neck, and the head is held closely to the body. The wings often droop, the sick fowl sometimes standing with closed eyes assuming a moping appearance; gaping and regurgitating movements are sometimes noticeable.

The droppings are of a greenish-yellow colour and, as a rule, of a diarrhœal nature. The feathers below the cloacal opening are greenish-yellow tinted with faecal matter.

The comb varies generally from a dark-red to a purplish-blue colour, but occasionally some individuals may manifest an anaemic appearance, especially of the wattles.

There is a high fever varying from 107.5° to 111.5° F. The sick birds often feel quite hot to the touch when picked up from the ground. There is a loss of condition, and just before death there is marked prostration and often profuse diarrhœa. The fowl becomes comatose and the temperature sub-normal.

Reference to appendix shows two typical fowl typhoid temperature charts of fowls where the disease has been produced experimentally at the Laboratory.

POST-MORTEM APPEARANCES.

Rigor mortis or stiffening sets in immediately after death. The skin in the region of the breast is sometimes of a reddish colour and the subcutaneous vessels slightly injected.

On opening the abdominal cavities an excess of amber or blood-stained fluid is often present.

The liver is the most constantly affected organ in avian typhoid. It is much enlarged in the initial stages of the disease. The surface is smooth and of a dark-red colour, displaying also yellowish patches. On incision the liver is rich in blood and quite friable in consistence. If the disease is of more than a week's standing, irregular multiple necrotic spots or greyish specks are often seen. If an incision is made, these specks are noticeable under the capsule and throughout the liver substance. These specks may be scattered or very numerous.

The spleen is also as a rule enlarged. When this organ is much enlarged, greyish irregular specks are just noticeable under the capsule. The organ is of a dark-red colour.

The kidneys are generally swollen, rich in blood, and of a yellowish-brown appearance.

The lungs are often hyperaemic or reddish and oedematous, especially when there is fluid in the body cavities. On cutting into the lung substance, a frothy fluid is sometimes ejected from the bronchial tubes.

The heart is, as a rule, filled with coagulated blood. It sometimes displays large, irregular haemorrhages on the surface, which is of interest, as this feature is held by some as diagnostic of fowl cholera. In South Africa haemorrhages on the epicardium and auricles were seen in three epidemics out of the four which came under observation. The heart sack generally contains an excess of fluid.

The intestines are, as a rule, pale, and show nothing but yellowish mucoid or greenish contents, but sometimes there may be catarrhal enteritis with irregular haemorrhagic patches on the lining mucous membrane.

The cloaca generally contains a soft greenish-yellow faecal matter.

RECOMMENDATIONS FOR COMBATING THE DISEASE.

(1) Sanitation is of primary importance in controlling any epidemic in poultry.

(2) Have fowls penned off from the free range at the time of the outbreak to diminish the danger of spreading of the disease.

VETERINARY EDUCATION AND RESEARCH DIVISION.

ANIMAL:

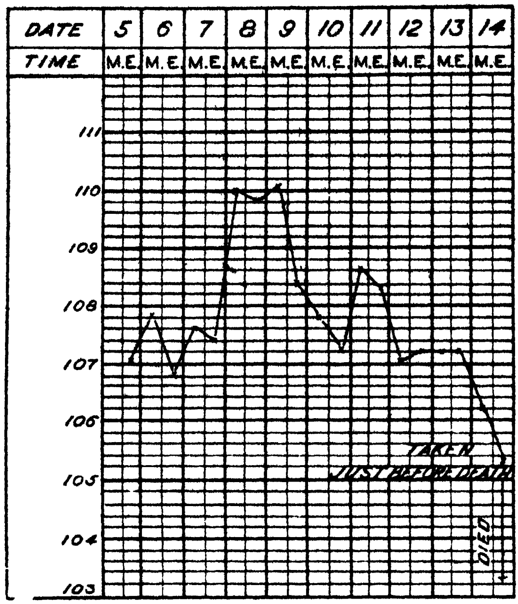
Fowl.

No. 3, Natal.

Date: 5/5/25.

REMARKS:

Fed with a 24-hour-old culture on bran mash.



VETERINARY EDUCATION AND RESEARCH DIVISION.

ANIMAL:

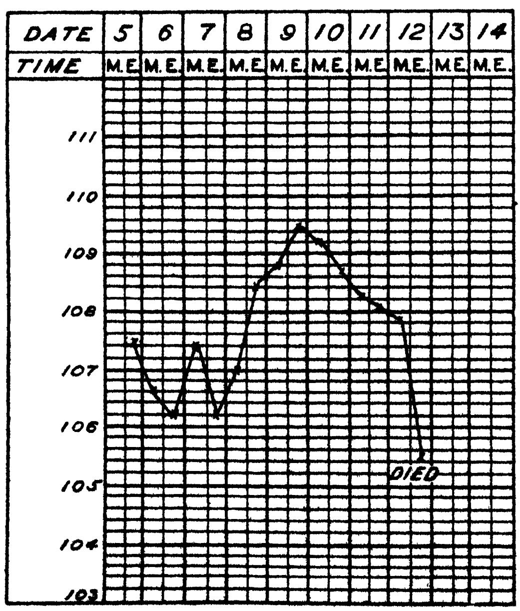
Fowl.

No. 1, Natal.

Date: 5/5/25.

REMARKS:

Fed with a 24-hour-old broth culture on bran mash.



Temperature Charts of Experimentally Infected Fowls.

(3) All in-contact fowls should be segregated, the sick birds killed off, and the carcasses, with those which have died from the disease, destroyed by burning.

(4) The droppings should be collected daily, and burned or sprayed with any of the standard disinfectants.

(5) Disinfect walls, floors, and perches of the fowl-house with a spray pump, using any efficient disinfectant.

(6) Remove all shade-producing vegetation from the old runs and dig in lightly 1 to 2 inches deep unslaked lime and allow to remain unoccupied, if possible, until after the winter.

(7) The water supply should be plentiful and free from contamination. Fresh water should be given at least twice daily.

(8) All receptacles for food and water should be scalded with boiling water, containing caustic soda, so long as the epidemic rages.

(9) Spreading of the disease from the sick birds by rats, sparrows, or any other probable vectors should be guarded against.

(10) Birds which have returned from shows, or stock birds which have been purchased from another breeder, should be isolated in a separate pen, removed as far as possible from the fowl-runs, for a period of two weeks, in order to guard against the introduction of this disease.

(11) Take the temperatures of your sick birds, as a high temperature would help you in arriving at an early diagnosis.

(12) Send one or two of your sick birds in a box, which will prevent possible spread of the disease en route, by passenger train to the Laboratory for examination and diagnosis. If fowl typhoid is present a prophylactic vaccine can be prepared which is efficient in reducing the mortality.

(A pamphlet by D. T. Mitchell, M.R.C.V.S., on the "Diagnosis of Disease in Poultry and the Despatch of Specimens" may be procured by writing for it.)

Labels for the free dispatch of specimens can be supplied on request by the Veterinary Research Laboratories at the following addresses:—

Onderstepoort Laboratory,
P.O. Box 593, Pretoria.
Rail, Pretoria North.

Allerton Laboratory,
P.O. Box, 405, Pietermaritzburg.
Rail, Victoria Station.

FOWL TYPHOID VACCINE.

Vaccines are issued free of charge only to owners, where the disease has been definitely diagnosed, and under the following conditions:—

(1) That only 50 per cent. of the birds are inoculated and that these are marked in such a way that they can be identified for three months.

(2) That a record of mortality from the marked and unmarked lots is kept.

(3) That all birds which die are forwarded to the Laboratory for post-mortem.

(4) That the birds under test are not disposed of for a period of three months after inoculation.

(5) That a report on the test, at the end of three months, is submitted to the Laboratory.

Dose: 1 *c.c. per Fowl.*

(1) A hypodermic syringe of 1 c.c. capacity and, advisably, six hypodermic needles are necessary for the operation.

Procedure.

(2) Before the operation the syringe and needles must be sterilized by boiling for 15 minutes. During the operation dip each needle in a 75 per cent. alcohol or 2½ per cent. carbolic solution before the next bird is vaccinated.

(3) Inoculate under the skin of the inside of the thigh or under the wing.

(4) A second vaccination after an interval of a week may be advisable.

It is recommended that, to start with, only a small number of birds be inoculated: if no untoward results are observed within three days, the remainder may be done.

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PRUNING OF THE VINE.

By S. W. VAN NIEKERK, Government Viticulturist, and L. PERKINS, Dried Fruit Officer, Elsenburg School of Agriculture.

BEFORE discussing pruning generally it is necessary to thoroughly understand (1) reasons for pruning and (2) rules or natural laws which govern the growth of plants.

REASONS FOR PRUNING.

1. To prevent any damage during cultural operations, such as ploughing, etc., it is necessary that the vine should have a definite form and shape.

2. It reduces the amount of annual growth, and at the same time stimulates the necessary development of tissue, whether for wood or fruit, as each vine demands.

3. Not only is unnecessary wood suppressed, but worn out and injured parts are removed from the vine.

Certain laws control the development of plants, and these must be adhered to. These laws, as laid down by Quinn, are applicable not only to fruit but also to vines. When pruning vines, results are more certain than with any other plants. Those of primary importance may be set out as follows:—

1. The vigour of a plant or shoot is dependent on the leaf surface upon it.

2. The nearer a shoot approaches a vertical position the stronger will be its growth.

3. The nearer a shoot approaches a horizontal position so its vigour diminishes.

4. The lesser the number of eyes upon a cane the stronger will be the growth made by each individual shoot arising therefrom.

5. Deformations of any kind, such as those produced by wounds or compression of sap vessels, diminish the activity of vegetation of plants or of those parts situated above them.

6. Within certain limits the fruit production of any plant or shoot diminishes with increased activity of its vegetation.

7. When a number of shoots are growing at different levels upon the same plant, generally the topmost shoots absorb the most sap and outgrow those below.

8. If the root system be reduced the vigour of the top growth will be correspondingly diminished.

9. The smaller the number of fruits the better their quality and size (unless produced through excessive vegetation).

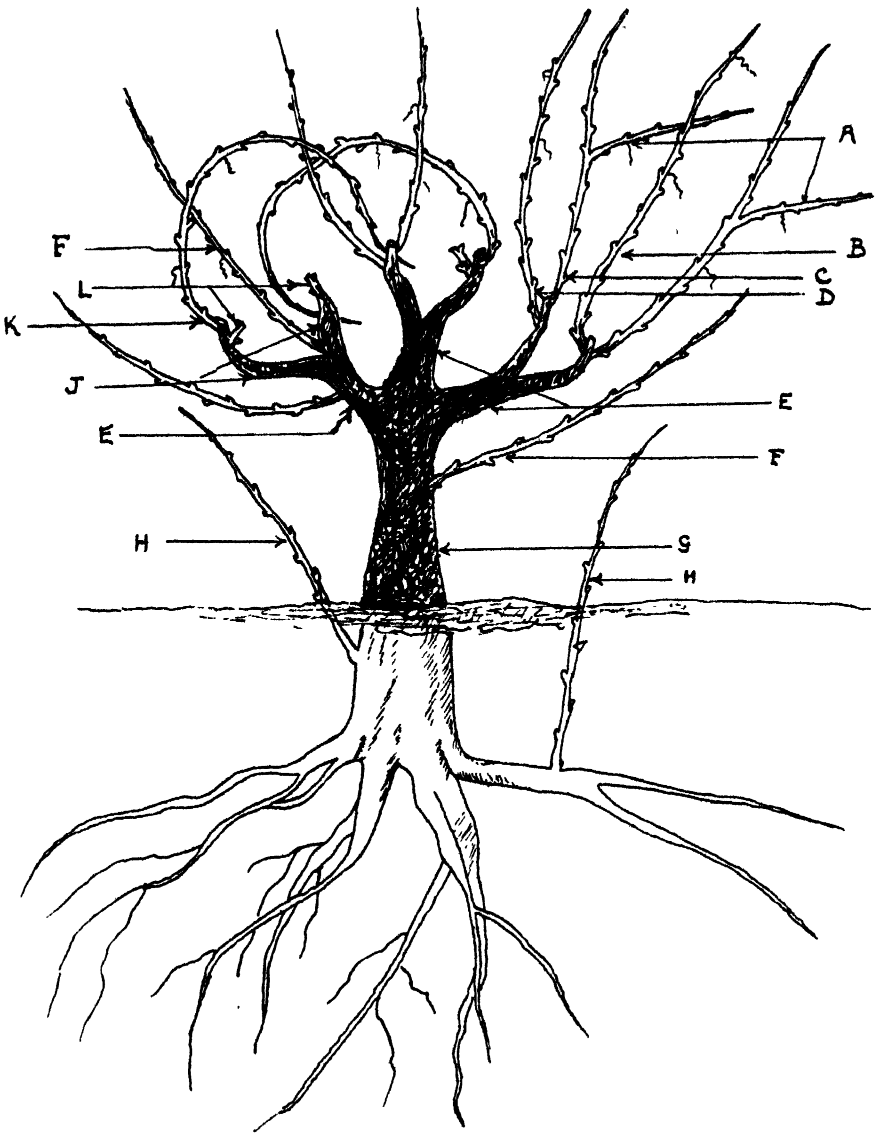

FIG. 1.—Diagrammatic sketch showing various parts of the vine.

[*After Laffer, N.S.W. Agricultural Department.*

A—Laterals.
B—Fruit-cane.
C—Old bearer.
D—New bearer.
E—Main arms.
F—Water shoots.
G—Stem or trunk.
H—Suckers.
J—Secondary arms.
K—Rod.
L—Spur.

Before pruning can be commenced it is necessary, first of all, to know where the different parts of the vine are situated and what they are called. Figure 1 shows the main stem which, arising from the ground, is the foundation of all the framework of the vine and is generally established during the second year of the growth of the vine. Growing immediately out of the stem are the main arms, which in turn bear the secondary arms. The main arm and main stem are the only portions of the vine which are permanent, the rest of the growth is apt to be severed at any winter pruning under certain conditions. The secondary arm usually becomes longer annually, and it is often necessary during winter pruning to reduce its length for economic reasons. This is usually done by cutting back to a suitably situated cane, when renewal is necessary. At the apex of the secondary arms are found the annual canes. These are valuable, in that they possess fruiting buds; indeed, they are often termed fruit canes.

Upon the vine are also found other growths, such as the water-shoot, a cane which does not arise from the ends of the secondary arms, but from either the main arms or upper portion of the trunk or main stem. This cane is termed a water-shoot owing to its vigorous growth, and arises from wood more than one season older than itself. A water-shoot is valuable for use in replacing a gap made by the loss of a secondary arm or for replacing a spur or secondary arm which has been elongated. Usually, however, it is completely suppressed. The sucker, unlike the water-shoot, is a shoot which occasionally arises from the ground surface and is pruned away. When the growth of a shoot is checked in summer it sends out secondary shoots. These are termed laterals.

Thus the vine consists of the main stem or trunk, main arms (permanent), secondary arms, fruit canes, water-shoots, suckers (temporary parts).

THE TREATMENT OF THE FRUITING WOOD.

An examination of figure 1 shows that those shoots which have arisen from what has been retained of the growth of the previous season are pruned, but they have not all been treated alike. Some have been cut so that only two buds are visible upon them, whilst others have been bent over in the shape of an arch or tied straight out horizontally. These are the portions of the canes retained after pruning takes place, and they are known as spurs and rods respectively. We may therefore define a spur as a portion of the last season's wood carrying from two to three buds. When counting buds, only those between which distinct internodes may be seen are counted. A rod has been described as a portion of the previous summer's cane, possessing more buds than a spur, usually from ten to sixteen, and sometimes more according to the growth of the vine.

SYSTEMS OF PRUNING.

Grape vines are naturally climbing plants, but under cultivation, for economic reasons, they are trained either as low bushes or on trellises, the only difference between the two systems being that the trellised plant is a vine with an elongated stem or branches. The form given the bush vine is known as the cup or goblet, while the

trellised vines are divided into the Guyot and Cordon systems. In all these systems modifications of long and short pruning may be practised. In other words, the systems of pruning are divided into:

(1) *A vine pruned to a head with short arms*—

(*a*) With spurs of two or three eyes only (short pruning).

(*b*) With wood spurs of one or two eyes and fruit canes four to six eyes (half long).

(*c*) With wood spurs of one or two eyes and long fruit canes (long pruning).

(2) *A vine with a long horizontal branch or continuation of trunk*—

(*d*) The same as (*a*).

(*e*) The same as (*b*) (sometimes termed Cazenave).

(*f*) The same as (*c*).

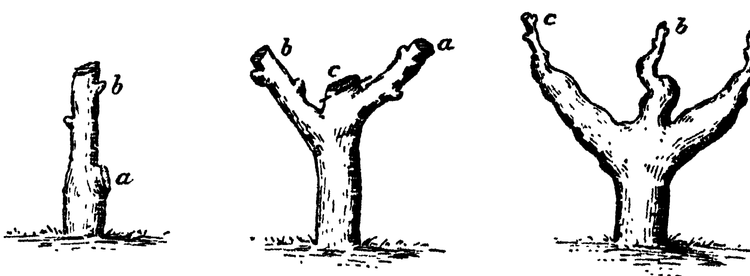

FIG. 2.—Establishment of a bush vine.

[*After Perold.*

WHEN TO PRUNE.

Theoretically, the vine can be given its final pruning as soon as it has dropped its leaves. This, however, is not always advisable. A preliminary pruning, on the other hand, is often practised, and providing this pruning is not done too early it is recommended. In this case all the unnecessary wood is severed from the vine, with the exception of the bearers and old bearers; and at times some growers prefer to remove everything with the exception of those canes to be utilized as fruit bearers the coming season. Since this work is always done at a time when farm work is slack and since the final pruning is thereby accelerated to a great extent, much can be said in favour of this way of pruning. The main question, however, remains—"When must I perform the final pruning of my vineyard?" Most vineyards in the south-western Cape districts are pruned between the 15th June and the 15th August. Some farmers wait till the end of August, or till the vines already start budding, so as to let the vines bud later in order to protect them against non-setting of berries as well as spring frosts; it is also believed that attacks of anthracnose are thus diminished. Although opinions differ on this point, it nevertheless seems fairly certain that the budding of vines can be retarded by eight to fifteen days through late pruning (shortly before or during budding). Since vines pruned late bleed a good deal, they are somewhat

weakened thereby in the end. For this reason it is a good thing to adopt late pruning in the case of very vigorous vines which bear badly. They are thus weakened and bear better, the more so if one gives them many bearers. It is also believed by some, on the other hand, that vines pruned early bud early. It has been proved at Elsenburg that there is practically no difference in the budding of vines pruned between the 15th June and the 20th July.

HOW TO PRUNE A YOUNG VINE OF THE FIRST YEAR.

This must be left to some extent to the intelligence of the pruner and the system chosen for the growing of the vine. During the first season after the planting of the vine the root system is established, and it is not a good practice to endeavour to establish the stem the first season. Usually vines from the nursery are weak, and, in consequence, the pruning after planting out must be of a drastic nature. This consists of reducing the plant to a single shoot and suppressing all but one or two buds upon that one. This leaves it projecting about

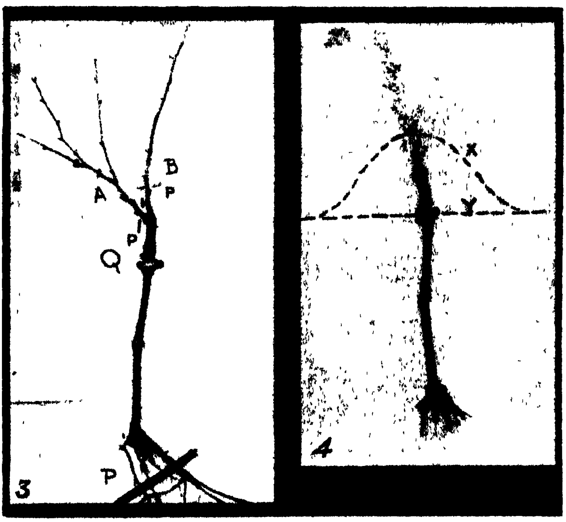

FIG. 3. Shows a young vine as received from nursery. Side shoot A should be severed at dotted line P, shoot B should be severed at dotted line P, leaving a vine with two eyes. The root-system is trimmed and pruned as shown at P. Q shows the graft union, and any roots arising from this point should be cut clean away.

FIG. 4.—A vine as planted in the vineyard. Y represents the ground-surface, and when planting the union mark should be about ½ in. above this. After planting, to protect the young growths from the heat and at the same time give the young vine rigidity, X represents the mound of fine sand or earth thrown up for protection.

[*Photos L. Perkins.*

two or three inches above the soil only, and frequently at the next winter pruning the shoots arising from these buds are erroneously chosen for the main arms. This is an attempt to save time, which results in forming the vine too low. If after the first season's growth the vines are still weak, it may be necessary to cut back to one or two eyes so as to get a strong shoot the following year. If the vines make a strong growth the strongest and most upright cane is chosen, suppressing the rest.

This cane may be left 6 to 10 inches long (from ground surface) to form the stem. The bottom buds may be removed, leaving only two or three eyes. When considering the pruning of the first season, all depends upon the growth of the vines made after the planting as to whether the stem should be formed the first season.

If too weak a growth is made, cut the vines back again to two eyes, and, if strong, establish the stem. At the same time it would not be advisable to cut back the majority of strong vines because of a few weak ones, neither would it be advantageous to encourage the stem establishment of a few strong vines should the majority be weak.

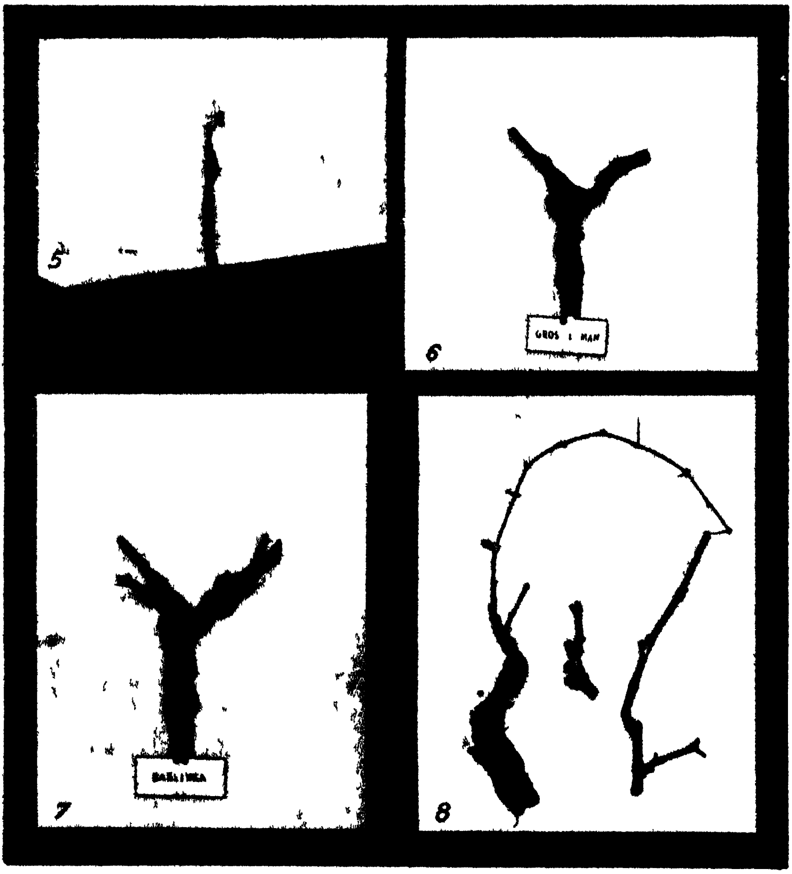

FIG. 5.—A one-year-old vine after first winter pruning.

FIG. 6.—A two-year-old vine after second winter pruning.

FIG. 7.—A four-year-old vine after fourth winter pruning.

FIG. 8.—Demonstrates the extremities of secondary arms of bush vines: No. 1, pruned long; No. 2, pruned short: No. 3, pruned half long.

[*Photos L. Perkins.*

At this point the pruning of vines, whether for bush or trellis vines, is the same, and it is here that it must be decided whether the vineyard is to be grown on the bush form or trellis.

Bush.—At this stage the head of the vine is established. The second year one leaves two spurs or arms, and, under exceptional circumstances, three spurs or arms, and to this one adds yearly

according to judgment. (If an arm has two canes as "*a*" and "*b*" in Figure 2, the "*b*" is called the bearer and "*a*" the "old bearer," which is removed when pruning, unless "*a*," on account of its better position, is left as a bearer and "*b*" is cut away, or both left as bearers in case one wants to "put on" an extra bearer.)

Trellis.—With the second year's growth one selects a strong cane, which is taken to the first wire, i.e. forming an elongated stem. Upon these stems is now practised either long, short, or half-long pruning. Figure 8 shows the extremities of secondary arms after pruning.

The first portion of the vine to the left is pruned long, bending the cane which bears the fruit this year, and also supplying a spur, from which will arise two canes, the one for bending the following year and the other for spurring back. The portion of wood shown in the centre represents a spur with two eyes used in short pruning.

FIG. 9.—A well-established bush vine pruned short.

FIG. 10.—A bush vine pruned half long.

[*Photos by L. Perkins*

The portion of the vine to the right of Figure 8 shows half-long pruning. These three different systems of establishing fruiting canes and wood, as the case may be, are practised on trellised vines as well as bush vines.

Staking.—This is hardly ever necessary the year of planting out, but must be done during the first autumn or winter before the sap commences to rise. Stakes should be 24 inches to 27 inches long. In order to preserve green pine poles for this purpose, soak them in a copper sulphate solution of 5 per cent. It is not necessary to soak the whole of the stake in the solution, only that part driven into the soil. The treatment must be given within twenty-four hours after cutting the stakes. Staking is necessary in order to obtain vines with straight stems. The cane—6 inches to 8 inches long—used for the stem should

be tied to the stake. Subsequent summer growths from the topmost eyes must be lifted from the ground and tied to the stakes in order to prevent the wind blowing them off.

Short Pruning.—The winter pruning of the vine consists in cutting off a certain amount of mature wood of the immediately preceding season's growth, and occasionally of the older wood.

The main problem of short pruning resolves itself into determining how much and what wood shall be left. In all kinds of pruning most of the canes are entirely removed. In short pruning, certain canes are cut back to spurs of two or three eyes. The number of spurs is regulated by the vigour and age of the vine. This mode of pruning can be used only for varieties in which the eyes near the base of the cane are fruitful. For all other cases long or half-long pruning is necessary.

FIG. 11.—A bush vine pruned long. No stem is visible owing to recent ploughing.

[*Photos by L. Perkins.*

In short pruning, all suckers, water-shoots, etc., are suppressed during the preliminary pruning which takes place during the early autumn. Only two canes on each secondary arm are left, termed the old and new bearers. During the final pruning the old fruiting cane is removed and the new bearer reduced to two or three eyes, according to the vigour of the vine.

In *half-long pruning* certain canes are left with four to six eyes. These canes or fruit spurs will bear more fruit for three reasons:—(*a*) Because there will be more fruit-bearing shoots; (*b*) because the upper eyes are more fruitful than the lower; (*c*) because a larger number of eyes being supplied with sap from the same arm, each shoot will be less vigorous and therefore more fruitful.

Owing, however, to the tendency of the plant to expend the principal part of its vigour on the shoots farthest removed from the base of the canes the lower eyes on the long spurs will generally produce very weak shoots. In order to obtain spurs of sufficient vigour for the next year's crop it would be necessary to choose them near the ends of the long spurs of the previous year, if no others were left. This would result in the rapid and inconvenient elongation of the arms; in order to avoid this it is necessary to leave a spur, that is, near the stem or trunk. These short spurs, having only one or two eyes, will produce vigorous canes for the following year, and the spurs which have borne fruit may be removed altogether, thus preventing an undue elongation of the arms. In half-long pruning, however, it is very hard to maintain the proper balance between fruitfulness and vigour; if a little too much wood is left, the shoots from the wood spurs may not develop sufficiently, and we may have to choose between leaving small undersized fruit spurs and spurs too far removed from the stem.

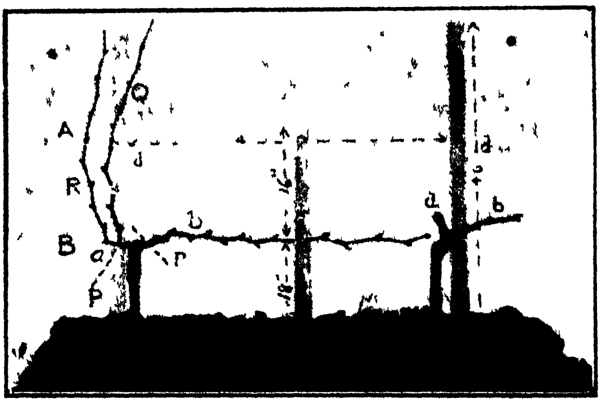

FIG. 12.—A vine trellised according to Dr. Guyot.

[*Photo by L. Perkin*

Long Pruning.—In long pruning, the fruit spurs of half-long pruning are replaced by long fruit canes; these are left from two to three feet or longer. The danger here that the vine will expend all its energies on the terminal buds of these canes is still greater than in half-long pruning. This difficulty is overcome by bending or twisting the fruit canes in some manner. The bending causes a certain amount of injury to the tisues of the canes, which tends to check the flow of sap towards their ends. The sap pressure thus increases in the lower buds and forces them out into strong shoots, thus distributing fruit wood along the cane at suitable intervals instead of giving only a few at the tip; at the same time it also gives the spur a chance to develop. The bending has thus the further effect of diminishing the vigour of the shoots arising from the terminal buds on the fruit canes and so increasing their fruitfulness.

This principle of increasing the fruitfulness by mechanical injury is very useful when properly applied. In the bush form, vines long

pruned may be twisted as in Figure 11 or tied to a stake driven into the ground beside the vine, or, as will be shown later, the canes, instead of being twisted, may be bent and tied to the wires.

TRELLISING.

There are many systems of trellising, but which for the most part are modifications of either the (1) Guyot or (2) Cordon systems.

(1) *Trellising According to Dr. Guyot or Renewal System.*—Each vine is given a spur with two eyes and a long bearer with approximately ten eyes, as shown in Figure 12.

In Figure 12, "*a*" is the short and "*b*" the long bearer. At each vine a stake, "d," is to be placed, which stands about four feet six inches above the ground. To this stake the long shoots (Q, R) of

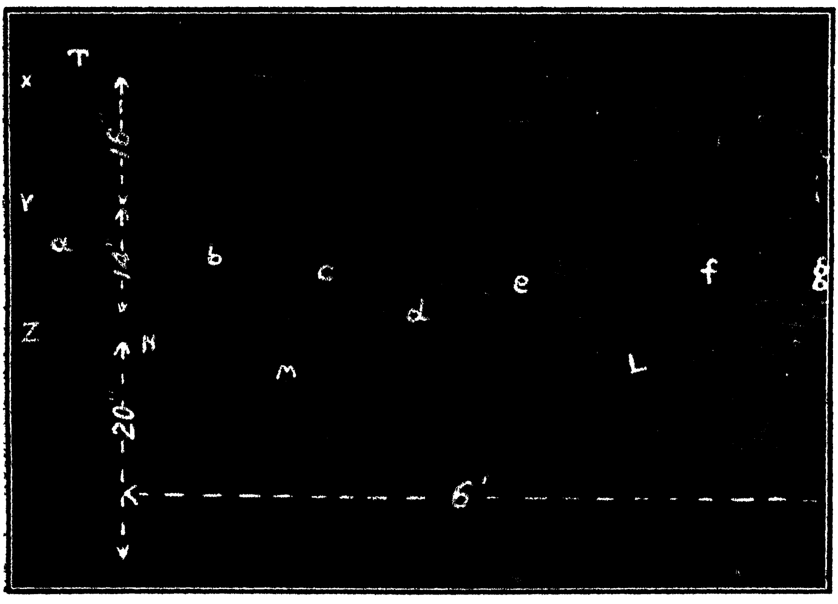

FIG. 13.—A "Cordon" pruned vine.

[*Photo by L. Perkins.*

bearer "*a*" are fastened. The first wire is drawn approximately eighteen inches above the ground (Figure 12 B). The long bearers are trained along it and tied to it. It must therefore support the weight of the grapes. Dr. Guyot recommends a shorter stake between every two vines to help in supporting the grapes. This is not necessary, however. The stake is 2 feet 6 inches above the ground. A second wire is fixed 16 inches above the first, and hence 34 inches above the ground (Figure 12 A). To this wire the shoots of the long bearer are fastened, as may be clearly seen from Figure 12. The pruning in the fourth year is now very simple. The dotted lines (P) show where the canes should be cut. One sees the old long bearer is cut off close to the trunk. Cane (R) now becomes the short bearer with two eyes,

and cane (Q), the old one with ten or more eyes, now in its turn is bent and fastened to the lowest wire. In this way each vine gets every year its short and long bearer. Sometimes the cane is trained into two directions, each one getting a short and a long bearer. In this case one long bearer is led to the right and one to the left. Here one can plant the vines 6 feet apart in the row without the length of the long bearers having to exceed 3 feet. When leaving only one spur and one bearer on each vine the vines should not be planted farther apart than 4 feet to 5 feet in the row, for otherwise the long bearers would have to be pruned too long.

(2) *Trellising According to Cordon.*—This is one of the methods most in vogue. Figures 13, 14, and 17 clearly illustrate this system. The distance between the stakes may be from 6 feet to 8 feet. Two wires are spanned in such a way that the first wire is 20 inches above the ground, the second 16 inches higher. In the first year the vine is given one spur with two eyes as usual. In the second year one long cane is trellised as a permanent trunk on the first wire, and, if possible,

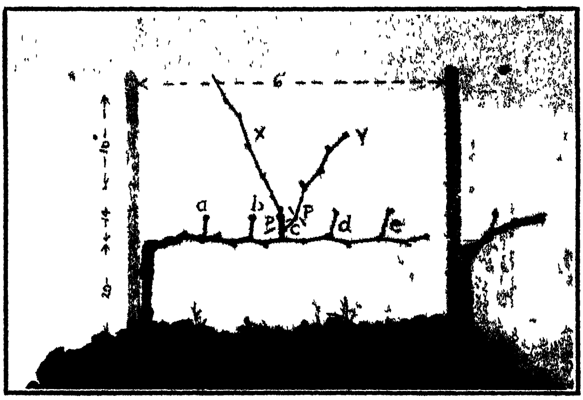

FIG. 14.—A "Cordon" pruned vine.

[*Photo by L. Perkins.*

6 inches along the wire. Should the vine still be too weak this can possibly be only done in the third year.

The shoot arising from the terminal bud is trained along the wire during summer. This cane is cut during winter to about 18 inches. This must be done, for if this cane is left too long the tendency of the vine will be to spend all its vigour on the terminal buds, and there are no spurs at suitable intervals.

The following year the terminal bud of the cane left the preceding season is again trained along the wire. If the growth is satisfactory it can probably be cut off when it reaches the next vine. The pruning of this vine will easily be understood from Figure 21. Very often the stem is trained in two directions, to the right and left of the trunk along the wires. This, however, is not recommended. On the permanent trunk in the following year canes are selected at regular intervals of about 9 inches as spurs. In the preceding summer all shoots are fastened to the top wire and topped about 1 foot above the wire.

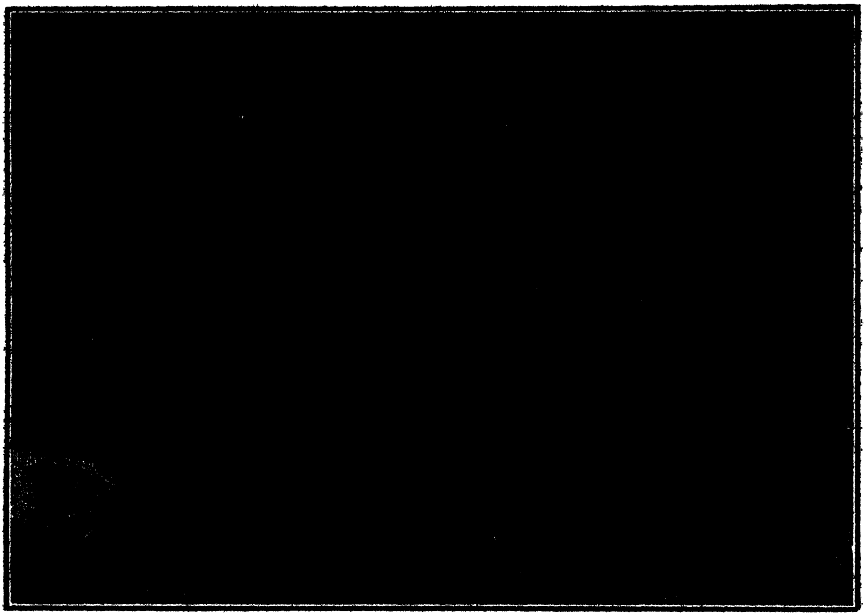

FIG. 15.—Cazenave trellising.

[*Photo by L. Perkins.*

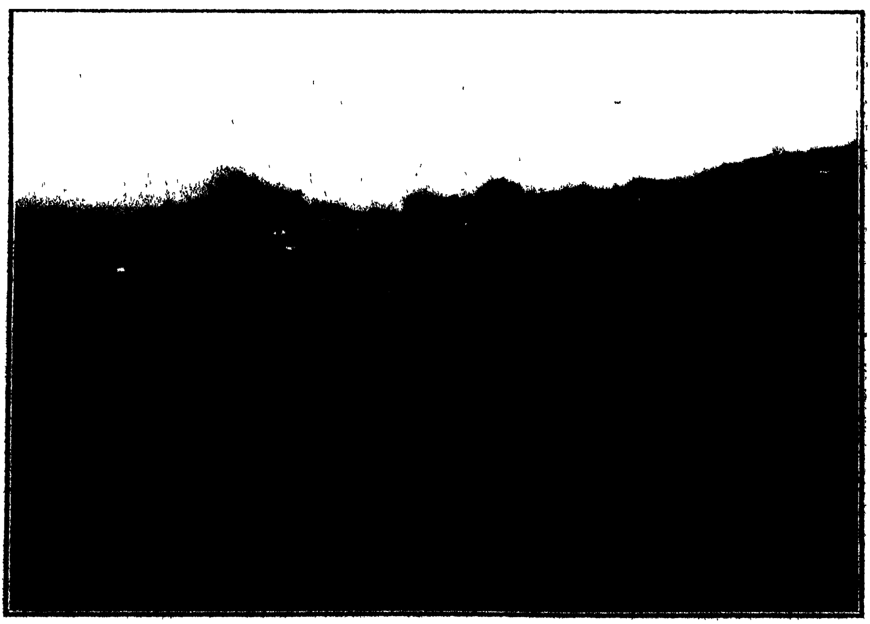

FIG. 16.—Vines pruned long. Trellised by the "Fish Spine" method.

[*Photo by L. Perkins.*

FIG. 17. A general view of a vineyard of horizontal Cordons.
[Photo by L. Perkins

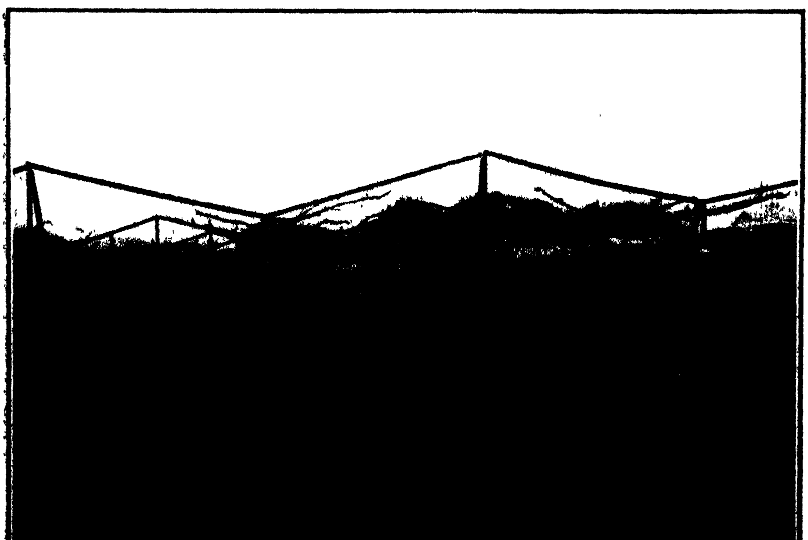

FIG. 18.—An "over-head" system of pruning similar to that used when trellising grapes on a pergola.

[Photo by L. Perkins.

After this system has been established modifications in pruning can be practised on same, such as half-long pruning, also called Cazenave, or the half-long canes may be replaced by long canes.

Cazenave.—In order to establish this system proceed with the treatment of the young vines as in the Cordon system, obtaining spurs. Upon these spurs half-long pruning is practised.

Figure 19 shows two successive arms on the permanent trunk as they are in the following year without being pruned. The first arm shows the result of a bearer which was given six eyes in the preceding year, whilst the second arm shows a bearer which was given only two eyes. The dotted lines (P) illustrate where the canes should be pruned. Hence, one now leaves a short bearer with two eyes (above A) and a long one with six eyes (above B), whilst the "oude nagel" is removed, as shown by the dotted line (P).

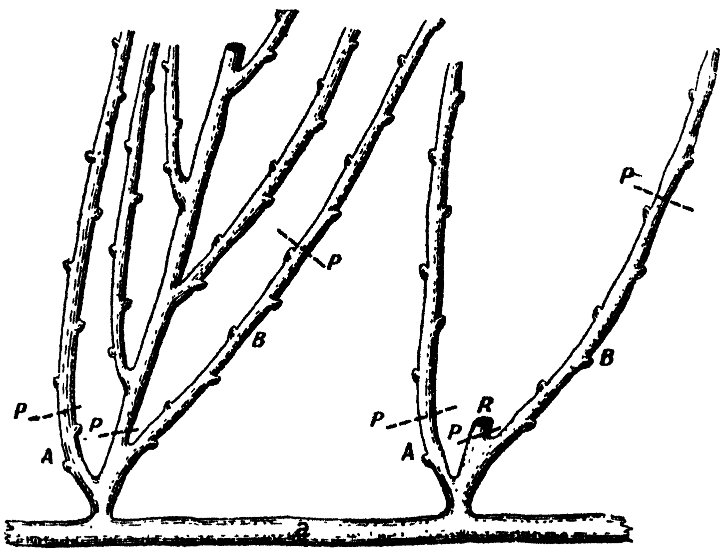

FIG. 19.—Trellising according to "Cazenave" (4th or 5th year).

[After Perold.

The long bearer (B) is now fastened to the second wire. In the next year every arm presents itself more or less as shown in Figure 20. For the sake of clearness not all the canes are given, whilst those on bearer (C) are only shown as single lines.

Now bearer (C) is taken away close to the trunk. (A) and (B) are pruned at the dotted lines (P), and remain as the short and long bearers respectively. The long bearer (B) is now again fastened to the second wire or bent out as shown in Figure 16 in the "Fish Spine" method of Cazenave pruning. Each arm on the permanent trunk is pruned year after year in the manner shown in Figure 20. If the arm in course of time gets too long it can be cut back, as was the case in half-long pruning. In the following year Figure 19 applies again, and then Figure 20 for the rest. The lowest wire, on which the permanent trunks rest, must be shown in Figure 15 or

16, whilst the middle and top wires may be somewhat thinner, as in Figures 12 or 13. Galvanized iron or steel wire, which consists of one wire or several thinner wires twisted together, should be used.

SUMMER PRUNING.

The treatment during the spring and summer is of great importance to the future welfare of the vine. A little judicious care at this period will avert many troubles in later years. It will be necessary to go over the vineyard several times to do the pinching, suckering, sprouting, topping, and occasionally the removal of leaves.

Pinching.—This consists of the removal of the extreme point of a young growing shoot. The object is to strengthen the young shoot

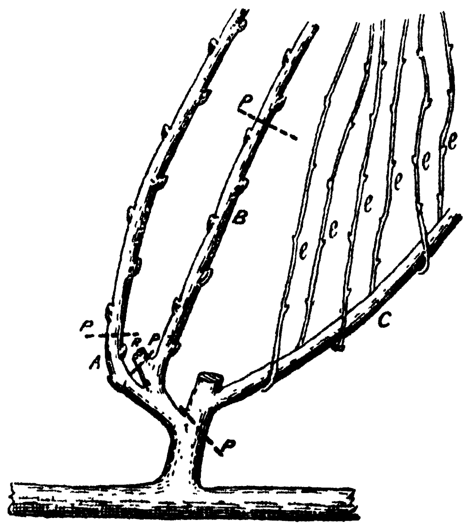

FIG. 20. Trellising according to "Cazenave" (5th or 6th year).

[*After Perold.*

so that it can withstand wind, etc.; it is also claimed to prevent non-setting or running off ("afloop"). The immediate result of pinching is to concentrate the sap in leaves and blossoms of shoots. If long pruning is done then pinching should only be done to the fruit shoots; the shoots intended for the next year's fruit canes should be left untouched. With us the term "pinching" is never used. But whenever the top part of any shoot is removed it is termed "topping," which in reality means a more severe cutting back of the ends of shoots, and is done by means of a sickle, a sharp rod, or a long knife. The question as to whether vines should be severely topped or not is often a debated matter. Experiments show that a light topping is often preferable to no topping. But where vines have been topped two, four, or six leaves above the grapes the one with six leaves invariably gives the best results. Not only as regards sugar percentage, it also gives a better crop. Vines severely topped for a number of years often show signs of deterioration. It is also

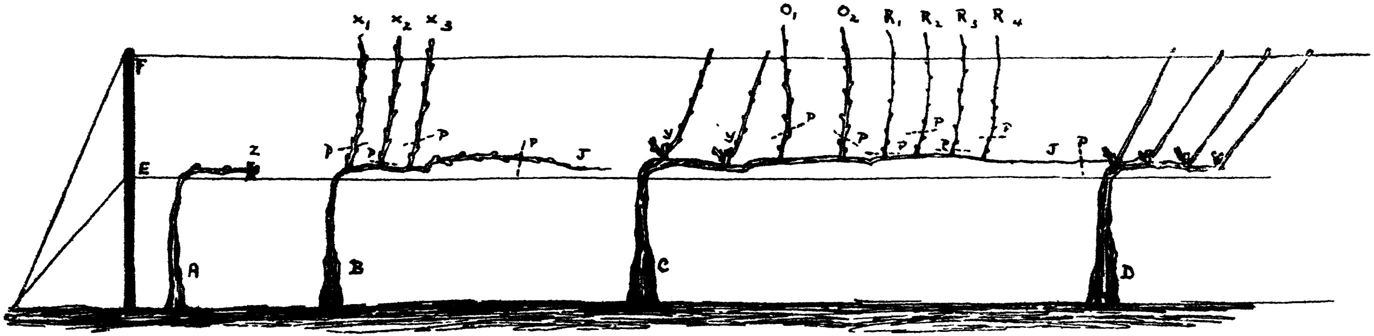

FIG. 21.—ESTABLISHMENT OF TRELLISED VINE BY THE "CAZENAVE" SYSTEM.

A shows 1st year pruning with vine tied to wire E at Z.

B shows the summer growth of A. and the method of pruning. Canes X_1 and X_3 are spurred back to P, while X_2 is suppressed altogether. J is pruned at P and tied to wire E.

C. This vine shows the second summer growth and method of pruning. Y shows the manner in which X_1 and X_3 have grown and are finally pruned the 3rd year of pruning. O_1 and O_2 are pruned at P. R_2 and R_4 are retained and spurred at P. R_1 and R_3 are suppressed altogether. J is continued as far as next vine D, and pruned at P.

D shows how the vine appears every successive year after it has been brought as far as the next vine.

claimed that vines severely topped over a number of years suffer more easily from the attacks of phylloxera when compared with non- or lightly topped vines. This is easily explained, as it is well known that the leaves assimilate an enormous amount of nourishment from the air, which again stimulates the growth of the vine, thereby strengthening it to resist phylloxera. The matter of topping, however, like all other operations in the vineyard must be decided by the grower as soil, climatic conditions, situation of the vineyard will have to be taken into consideration.

Suckering is the removal of shoots which have their origin near or below the ground. It is undoubtedly a good practise to remove all shoots arising from the stem as well as those coming from under the permanent arms. If these shoots are removed during summer it greatly facilitates the final winter pruning. These shoots should be removed when they are from four to six inches in length, before they are lignified, when they can easily be broken by hand without damaging the mother plant.

Sprouting usually covers the above, but goes a step further. in that all shoots having no fruit are removed, especially those arising from the main arms. With us it has been proved that for wine-making purposes this is not a desirable practice, as our summers are usually fairly hot. With a cool summer it has been a success. The idea of removing all these shoots is, of course, to concentrate all the sap into the fruit. This practice, however, is often carried out with table grapes, but even in this case it is doubtful except in favourable localities.

Removal of Leaves.—In order to allow the sun to penetrate and help the ripening of late grapes it is often advisable late in the season to lessen the leafy shade of the vine. In certain localities, especially under unfavourable climatic conditions, grapes often do not ripen properly or they are liable to rot. In such cases it is advisable to remove the lower leaves round about the bunches, and perhaps a few above them, so as to expose the bunches to air circulation and the action of the sun. This operation should only be done after the ripening stage of the grapes is well advanced.

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STUDIES IN THE COST OF PRODUCTION OF BEEF.

Interim Report on Experiments Conducted at the Cedara School of Agriculture, Natal, from March, 1923, to October, 1925.

(*Under direction of Division of Field and Animal Husbandry.*)

By Dr. A. E. ROMYN, Ph.D., M.Sc., B.Sc. (Agr.), H. J. VAN DER MERWE, M.Sc., C. B. ROBERTSON, and S. M. PINCHIN (with an introductory note by Dr. A. E. ROMYN).

INTRODUCTION.

THE beef situation in South Africa is obscure. There are, however, certain possibilities which should be borne in mind in forecasting the future of the industry.

To the writer, these appear to be:—

1. The producer of good beef will have to look for his market overseas. The local demand for good beef is relatively limited. The increasing number of cull dairy stock, the increase of kaffir cattle shown in the 1923-24 census, and surplus trek oxen marketed as beef will, in time, so depress the price for beef cattle on the local markets that, once prime beef is produced in any quantity, it will not be saleable at prices remunerative to the producer.

2. Cattle intended for the overseas market will have to be well fed. Cattle which have once been allowed to lose much condition never produce flesh with the bloom and appearance required by an exacting market.

There is a tendency at present to believe that a good market on the Continent can be found for cattle of medium grade. There are already signs, however, that the continental market is becoming more discriminating in its tastes, and cannot be relied upon to absorb inferior meat indefinitely.

3. The future of beef production, in countries suited to the production of beef, seems promising. Owing to a world-wide curtailment in the production of beef cattle, the authorities on the world meat situation seem to expect a steady improvement in the prices for beef cattle for the next five or six years.

4. As far as the Union of South Africa is concerned, the area suitable for ranching is relatively too limited to have much effect on the general situation. If the beef industry develops, it will probably be chiefly along the lines of—

(*a*) the fattening in the maize-growing districts of steers raised on cheap land in the north;

(b) the production of good two and three year old steers by a semi-intensive form of beef raising. such as has been followed in the experiments at the School of Agriculture, Cedara;

(c) a temporary export of well-bred steers on the hoof.

These experiments, which are a departure from the usual practice on many farms, should therefore be studied with the foregoing possibilities in mind.—(A.E.R.)

GENERAL REVIEW.

On account of the high price of land the raising of beef cattle on an extensive scale in the midlands of Natal appears to have ceased to be a profitable enterprise.

Experiments have therefore been planned to investigate, as far as is possible under the conditions obtaining on an experiment station.

FIG. 1.
Beef Herd.

certain costs and systems of management in the raising of beef cattle under semi-intensive conditions. These experiments have been in progress since March, 1923. It is felt that a progress report on certain phases of the experiment can now be made.

These experiments will not be completed until three crops of calves have been marketed. This will not be until September or October, 1928. In the meanwhile, some of the findings are of interest, but should be accepted with caution on account of the limited data at present available.

The general system of management followed is to allow the cattle to remain on the veld throughout the year.*

During the summer the cattle get the ordinary grazing with no supplementary feeding. During the winter a sufficient roughage ration and a small amount of some protein concentrate are fed to

* An exception was made in the winter of 1921.

enable the stock to maintain normal growth. During the summer months the grazing is restricted to as small an area as it is estimated will afford normal growth for that period of the year.

FIG. 2.
Breeding Herd—April, 1925.

FIG. 3.
Breeding Herd—May, 1925.

The cattle used are pure-bred Aberdeen-Angus, and are of a considerably higher standard than the cattle found in an ordinary beef-producing herd.

The veld is good typical sour veld of a carrying capacity, up to the present, of one cow and calf to 2-3 acres per year.

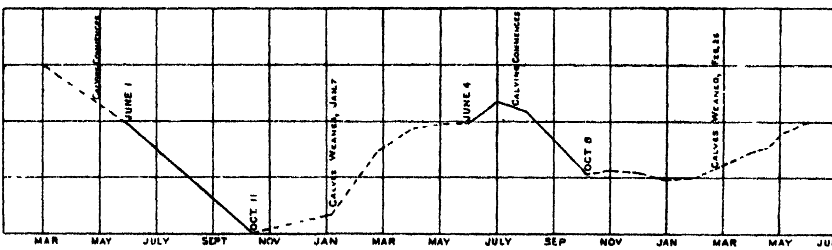
Shelter is provided by belts of gum trees. There is abundant water in all the camps.

The cows so far have calved during the winter months. The bull runs with the herd from October to December. It is planned to sell the young stock at the end of their third winter as three-year-olds. All the heifers are spayed and treated as steers. The market cattle are stall-fed for the last winter.

In addition to the usual stock and calving records, records are kept of the feed, labour, grazing, and equipment used. The cattle are weighed once a month throughout the year. Whenever a radical change is to be made in the system of feeding, three weighings are made on successive days.

During the winter the cattle are fed in troughs once daily in the open. The young stock are fed all the roughage that they will clean up. The cows get sufficient rough feed to keep them in a thrifty condition. A light supplementary ration of grain is fed to all the cattle.

GRAPH I.



Graph showing monthly weights of the cows.

The data which it is proposed to summarize here cover the following points:—

(1) The seasonal fluctuation in the weights of beef cows.
(2) The feed cost of wintering a beef cow and calf.
(3) The feed cost of wintering a yearling steer.
(4) The value of grain feeding for young stock on veld.

SEASONAL FLUCTUATIONS IN WEIGHT OF BREEDING COWS.

The cows in this experiment have generally been kept in what would be considered a somewhat low condition for pure-bred cows. Figures 1 and 2 illustrate well the appearance of the cows towards the end of the summer grazing season.

Graph I shows graphically the monthly change in weight of the cows from April, 1923, to June, 1925.

The cows were in too high condition at the commencement of the experiment, but speedily lost weight when left to their own devices on the veld. After this, their monthly fluctuations in weight and the relation of these weights to such factors as calving, weaning, winter feed, seasonal changes in the grazing, can be followed on the graph.

It will be noticed that—

(1) each year the cows have returned to an average weight of about 1,000 lb. by the beginning of June;

(2) the lowest weights for the year were generally reached shortly before the calves were weaned. This is to be expected;

(3) during the best grazing months of the year these cows, on good sour veld, while suckling calves, did little more than maintain their weight.

The calf crop each year developed well. Table I illustrates this.

TABLE I.

Weight of Calves at Weaning.

Year.	Age at Weaning.	Average Weight at Weaning.
1923-24............	208 days....................	350 lb.*
1924-25............	199 days....................	412 lb.

* On six calves; others not weighed at weaning.

It is therefore assumed that the system of feeding followed is a satisfactory one.

FEED COST OF WINTERING A BEEF COW AND CALF.

The feed cost of wintering a beef cow and calf has been as follows:—

Winter of 1923	£1	15	2
Winter of 1924	2	4	4
Winter of 1925	2	1	9

The data from which these figures are obtained are summarized in Tables II, III, and IV of this report, which give respectively—

(*a*) the amount and cost of the feed consumed; (*b*) the value of the feeds used; and (*c*) the change in weight and the calving record of the cows in the experiment.

TABLE II.

The Feed Cost of Wintering a Beef Cow and Calf.

Year.	Number of Cows.	Number of Cows which actually Suckled Calves.	Average Daily Ration (per Cow and Calf).† Protein Conc.(1)	Average Daily Ration Maize Silage.	Average Daily Ration Veld-hay.	Average Daily Ration Turnips.	Total Feed Consumed (Ten Cows and Calves). Protein Conc.	Total Feed Consumed Maize Silage.	Total Feed Consumed Veld-hay.	Total Feed Consumed Turnips.	Total Feed Consumed Salt.	Total Feed Consumed Bone-meal.	Total Feed Consumed Graz-ing.	Cost of Feed. Total.	Cost of Feed. Per Cow.	System of Feeding.
			lb.	lb.	lb.		lb.	lb.	lb.		lb.	lb.	Acres.	£ s. d.	£ s. d.	
1923	10	9	1·0	30·0	4·2	—	1,310	39,300	5.460	—	170	30	9	17 11 8	1 15 2	Veld.
1924	10	9	1·5	21·5	5·9	3·4	1,875	26.900	7,430	4,250	30	—	9	23 3 4	2 4 4	Covered kraals.
1925	10	8*	1·4	30·0	—	—	1,905	39.900	—	—	47	126	9	20 17 10	2 1 9	Veld.

(1) 1923—Peanut-cake meal.
1924—Cotton-seed meal.
1925—Peanut-cake and lobol-oil-cake meal.

* Including one cow, which aborted.
† There was a small consumption per calf towards the end of the winter.

During the winter the cows have been debited with a proportion of the year's grazing, though actually little use was made of it during the winter, except in 1925. It makes no difference to the yearly charge, however, whether the grazing is all charged in the summer or proportionately throughout the year.

TABLE III.

The Cost of Feeds Used.

Feeds.	1923.	1924.	1925.
Peanut-cake Meal..	9s. 6d. per 100 lb.	—	10s. 6d. per 100 lb.
Cotton-seed Meal...	—	11s. per 100 lb.	—
Lobol-oil Cake......	—	—	10s. 6d. per 100 lb.
Crushed Maize.....	—	—	5s. 6d. per 100 lb.
Maize Silage.......	10s. per 2,000 lb.	10s. per 2,000 lb.	10s. per 2.000 lb.
Turnips............	—	15s. per 2,000 lb.	—
Veld-hay.	10s. per 2,000 lb.	20s. per 2,000 lb.	—
Grazing............	6 per cent. on £6 per annum	6 per cent. on £6 per annum	6 per cent. on £6 per annum.
Salt...............	2s. 6d. per 100 lb.	2s. 6d. per 100 lb.	2s. 6d. per 100 lb.
Bonemeal..........	8s. 6d. per 100 lb.	—	8s. 6d. per 100 lb.

The grazing charge is high, but is calculated on the actual value of the land.

TABLE IV.

The Weight Records of Cows.

Year.	Period of Winter Feed ng.	Number of Days.	Number of Cows.	Number of Cows which actually Suckled Calves during Period.	Average Weight at Commencement.	Average Weight at End.	Average Loss of Weight.	System of Feeding.
					lb.	lb.	lb.	
1923	June 2............ October 11..........	131	10	9	993	800	193	Veld.
1924	June 4............ October 6...........	125	10	9	993	909	84	Covered kraals.
1925	June 3............ October 14..........	133	10	8*	990	879	111	Veld.

* Including one cow which aborted.

From the foregoing data it appears that it has been necessary to "winter feed" these cows for about 130 days each year. In general, they have been fed from the time at which they started actually to lose weight on pasture until there was sufficient growth of grass in the spring to make supplementary feeding uneconomical.

During the winter the cows have lost an average of 129 lb. per head in weight; they have, however, always regained their normal weights by the commencement of the following winter.

In no year has it been possible to get more than nine calves from the ten cows. During the winter of 1925 only seven calves were raised from the ten cows. That year one aborted, making a total of eight calves born. This cow lost as much weight during the succeeding three months as any cow suckling a calf. To make good these deficiencies, the plan has been to add other *comparable* calves at the time of weaning to make the lot up to ten. Also, where a cow has proved an irregular breeder, it has been changed for a *comparable* one at the same time and the necessary adjustments made in the records. These substitutions were made in such a way as to affect as little as possible the total weights of the groups and so not invalidate the yearly weight records.

One calf was drowned and had to be replaced. This has, up to the present, been the only death in the experiment.

Feeding was done once daily, usually in the morning, as the cattle were then more contented for the rest of the day. The cake was fed on the silage in the troughs; the hay was supplied from a rack.

In the winter of 1924 the cows were fed at night in covered kraals, at the cow-byres, instead of on the veld, as was the case during the other two winters. This practice was not repeated as it was found difficult to keep the feeding of the beef cattle quite separate from the remainder of the farm herd.

Approximately the same quantities of feed were used each year. In 1924 turnips were fed instead of silage for a short period. In 1925, owing to the previous rainy season, the winter grazing proved unusually good. The cows refused to consume any veld-hay and did considerable grazing all through the winter.

Salt and bonemeal were not fed on a consistent plan till the winter of 1925.

Summary:

Feed Cost.—The average feed cost of wintering a beef cow and calf for the three winters 1923-24-25 has been £2. 0s. 5d.

Under the system of management followed, and with the prevailing prices, this seems a representative figure.

Feed Consumed.—The average daily ration for the three winters 1923-24-25 has been:—

Protein concentrate...	1·3 lb.
Veld-hay	3·3 lb.
Succulence (maize silage or turnips) ...	28·3 lb.

Weights Lost.—On these feeds the cows lost an average of 129 lb. per head in 130 days, but reared calves which, at weaning age of 203 days, averaged 381 lb. in weight.

FEED COST OF WINTERING A YEARLING STEER.

The feed cost of wintering a yearling steer has been as follows:—

Winter of 1924...	£1 16 5
Winter of 1925...	1 12 0

The data covering these figures are summarized in Tables V and VI.

TABLE V.

The Weight Records of Yearlings.

Year.	Period Winter Feeding.	Number of Days.	Number of Steers.	Average Age, commencement of Winter.	Average Weight, commencement of Winter.	Average Weight, end of Winter.	Average Gain in Weight.
				Months.	lb.	lb.	lb.
1924	June 4.................... October 6..................	125	10	13	512	536	24
1925	June 3.................... October 14.................	133	10	9	450	457	7

TABLE VI.

The Feed Cost of Wintering a Yearling Steer. (1)

Year.	Number of Steers.	Average Daily Ration Per Head.					Total Feed Consumed (Ten Head).								Cost of Feed.		System of Feeding.
		Pro-tein Conc. (2)	Maize.	Maize Silage.	Veld-hay.	Tur-nips.	Pro-tein Conc.	Maize.	Maize Silage.	Veld-hay.	Tur-nips.	Graz-ing.	Bone-meal.	Salt.	Total Cost.	Cost Per Head.	
							lb.	lb.	lb.	lb.	lb.	Acres.	lb.	lb.	£ s. d.	£ s. d.	
1924..	10	1·3	—	13·9	3·6	1·7	1,630	—	17,426	4,520	2,120	5	—	30	18 4 4	1 16 5	Covered kraals.
1925..	10	0·97	0·64(3)	14·7	—	—	1,290	850(3)	19,650	—	—	5	41	14	16 0 6	1 12 0	Veld.

(1) In 1924, six steers were actually spayed heifers.
In 1925, five steers were actually spayed heifers.
(2) In 1924, cotton-seed meal was used.
In 1925, peanut-cake meal was used with a small quantity of lobol-oil cake.
(3) In 1925, small quantity was fed as corn and cob. This has been recalculated as maize.

For costs of feed, see Table VIII.

For the prices of these feeds, see Table III.

From Table V it will be seen that the two crops of calves are not altogether comparable. Crop 2 was on an average four months younger than Crop 1 at the commencement of the winter feeding period. This was due to the fact that a dry spring in 1924 made it impossible to get the cows in calf again early enough to calve within the twelve months. The slightly better showing of Crop 1 may be due to its greater age.

In addition to a light grain ration, the calves were fed all the silage and hay that they would consume. Despite a ration that many farmers would consider quite adequate, the yearlings were, however, only able to maintain their weights Though they grew in size, they lost condition. This coincides with the experience of other countries, and goes to show that it is difficult to produce any considerable gain of weight on yearlings over winter by the use of roughage feeds alone.

Similarly to the cows, the steers did not consume any veld-hay in the winter of 1925. Bonemeal was fed throughout the winter of 1925, but not in 1924.

THE VALUE OF GRAIN FEEDING TO YOUNG STOCK ON VELD.

In Natal, under the system of management outlined, beef cattle usually reach market at about three years of age.

It was hoped, however, that through forcing the young stock by some grain feeding during the summer months it would be possible to market the cattle at a considerably earlier age.

To test this theory, each crop of calves was divided into two lots of five. The one lot was fed a grain ration during the summer; the other lot depended entirely on grazing. The lots are too small to be conclusive and the data cover only two seasons, but so far it is interesting to note that grain feeding has not been a success. The grain ration used varied from 1½ lb. per day for calves to 3 lb. per day for yearlings. While the grazing was good, only crushed maize was fed, but later, as the feeding value of the grass decreased, a protein concentrate was added to the maize.

In the first crop of calves the difference in weight between the no-grain and grain-fed on veld calves—at 2 years of age—was only 63 lb. per head.

This is shown in Table VII.

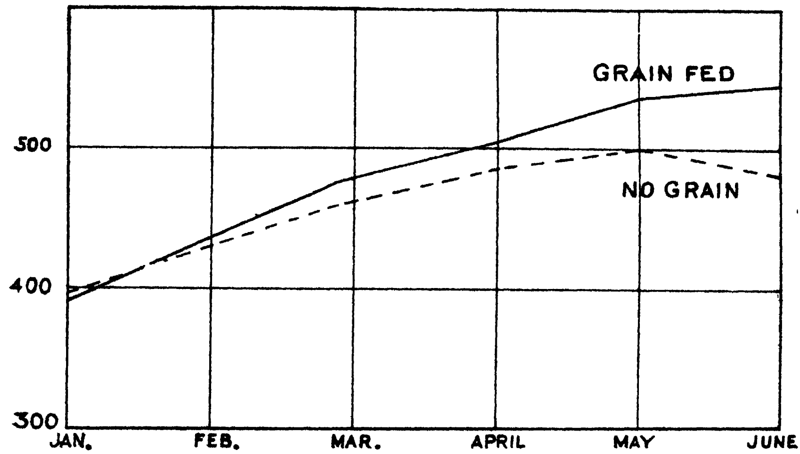
TABLE VII.

Certain Costs in Producing a Two-year-old Steer.

Lot.	Number of Head.	Average Weight at Two Years (5/5/25).	Supplementary Feed Used: Amounts and Costs.			Pasture.		Bone-meal.	Salt.	Native Labour.	Total Cost.	Cost Per Head.	Difference in Cost Per Head of Fed over Unfed.
			First Summer.	First Winter.	Second Summer.	First Summer.	Second Summer.						
		lb.	lb.	lb.	lb.			lb.	lb.				
Summer Fed	5	811	Corn and cob (555). Maize-meal (195) Nut-meal (376) £4 7 4	Cotton seed (815) Veld-hay (2,260) Silage (8,713) Turnips (1,060) £8 3 8	Corn and cob (450) Crushed mealies (2,130) Nut-meal (315) £11 7 9	$2\frac{1}{2}$ acres, 18s.	$7\frac{1}{2}$ acres, £2. 14s.	51, 3s.10d.	65, 1s. 8d.	238 hrs., £1 19 8	£29 15 11	£5 19 2	£3 9 1
Veld alone	5	748	Nil	Same as Summer fed £8 3 8	Nil	$2\frac{1}{2}$ acres, 18s.	$7\frac{1}{2}$ acres, £2. 14s.	51, 3s.10d.	65, 1s. 8d.	56 hrs., 9s. 4d.	£12 10 6	£2 10 1	

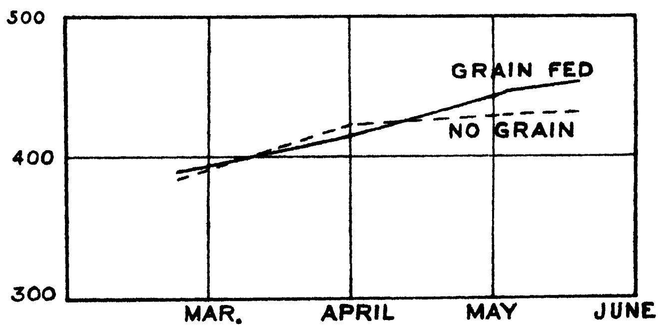
*These costs must not be taken for all the costs involved in the production of steers. For costs of feed. see Table VIII.

GRAPH II (*a*).



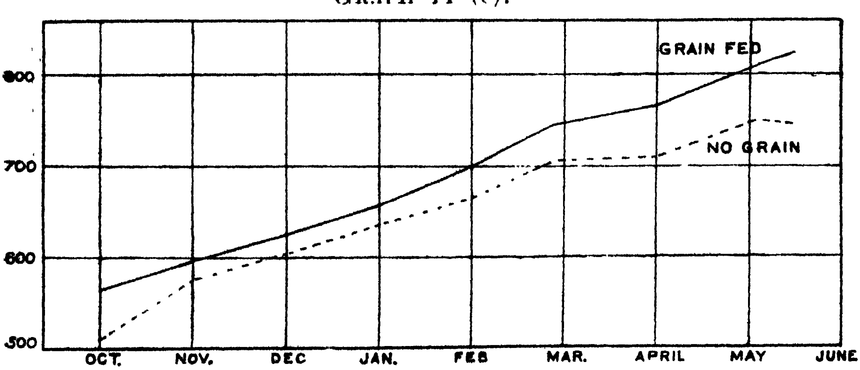
Calves, 1924.

GRAPH II (*b*).



Calves, 1925.

GRAPH II (*c*).



Yearlings, 1925.

For the cost of feeds, see Table III. For purposes of calculation the corn and cob has been converted to an equivalent quantity of crushed maize.

This increase was obtained at a cost of £3. 9s. 1d. per head. At two years, there was not this difference in sales value between the two

FIG. 4.—Grain-fed calves, May, 1925.

FIG. 5.—No-grain calves, May, 1925.

lots. It is quite probable that at the time of marketing, the difference in value between the two lots may still be much less than the cost of the extra feed.

The interesting feature of this difference in weight is that both in 1924 and 1925 it has only been marked from the month of April onwards.

This is brought out in Graphs II (*a*), (*b*), and (*c*), which serves to illustrate this point and give the summer weights of the calves or yearlings during the grazing seasons of 1924 and 1925. The weights of the calves are from the date of weaning to the commencement of the winter feeding.

The surprising small difference in weight between the two lots is attributed to the fact that the calves which were fed grain spent less time in grazing than the unfed lot. This would tend to decrease the economic value of the grain ration.

Figures 4, 5, and 6 illustrate the appearance of the calves.

From these data it would appear that the grain feeding has only been of economic value after the grass matured and became unpalatable.

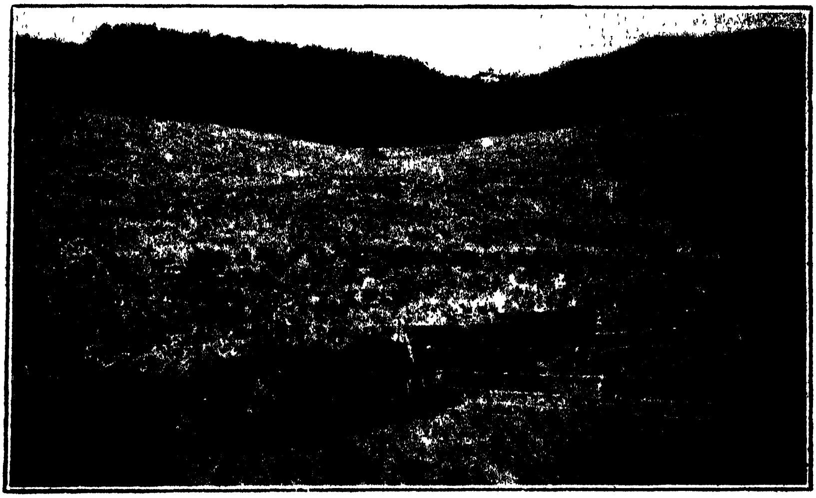


FIG. 6.—No-grain (left), and grain-fed yearlings, May 1925

TABLE VIII.

The Cost of the Feeds Used.

Feeds.	1923.	1924.	1925.
Peanut-cake Meal...	9s. 6d. per 100 lb.	—	10s. 6d. per 100 lb.
Cotton-seed Meal...	—	11s. per 100 lb.	—
Lobol-oil Cake......	—	—	10s. 6d. per 100 lb.
Crushed Maize.....	—	—	5s. 6d. per 100 lb.
Maize Silage.......	10s. per 2,000 lb.	10s. per 2,000 lb.	10s. per 2,000 lb.
Turnips...........	—	15s. per 2,000 lb.	—
Veld-hay..........	10s. per 2,000 lb.	20s. per 2,000 lb.	—
Grazing.....	6 per cent. on £6 per annum	6 per cent. on £6 per annum.	6 per cent. on £6 per annum.
Salt...............	2s. 6d. per 100 lb.	2s. 6d. per 100 lb.	2s. 6d. per 100 lb.
Bonemeal..........	8s. 6d. per 100 lb.	—	8s. 6d. per 100 lb.

WEEDS OF SOUTH AFRICA.

BY K. A. LANSDELL, Botanical Assistant, Division of Botany, Pretoria.

XIX.

[**Like other countries, South Africa is awaking to the importance of suppressing its noxious weeds, which, owing to the alarming rapidity of their spread in recent years, are becoming increasingly dangerous to our pasturage, wool, and other agricultural pursuits. While much has been done in the past to place the farmer in a position to recognize and cope with the danger, the problem grows in seriousness, and the time has arrived when all information regarding the noxious weeds found in the Union should be gathered into one publication for the use of the farmer, the student, and the general public. This work has now been undertaken by the Division of Botany, the opening contribution, continued hereunder, appearing in our April, 1921, number. The publication, which includes an illustrated glossary on the morphology of weeds, is the first of its kind in South Africa, and will continue to appear in serial form in the *Journal*. Thereafter, the series will be reprinted in bulletin form, with the addition of a coloured plate illustrating each weed dealt with.—EDITOR.**]

Weed No. 14.

THE CORSICAN THISTLE (*CARDUUS PYCNOCEPHALUS*, L.).
Order *Compositae*.

THE "Corsican Thistle," botanically known as *Carduus pycnocephalus*, L., is a native of the Mediterranean Region, and belongs to the family *Compositae*. It is a weed of recent appearance in South Africa, and has only been recorded here during the last five years, first from Nottingham Road, Natal (Plate IV).

It is found chiefly in pasture lands, fence rows, roadsides, and waste places, and is a troublesome weed in grain and crop lands.

The "seed" or achene is flattened, oblong in outline, curved to one side, shining, light-grey in colour, with greyish longitudinal markings, and the apex is tipped with white hairs (pappus) (Plate II, Fig. 1).

When the pappus becomes detached from the "seed" the apex of the "seed" is cup-shaped with a conical appendage in the centre (Plate I).

The "seeds" may be disseminated in various ways, e.g.:—

(1) As the plants grow in cultivated lands the "seeds" may be harvested with the crop and be present as an impurity (Plate I).

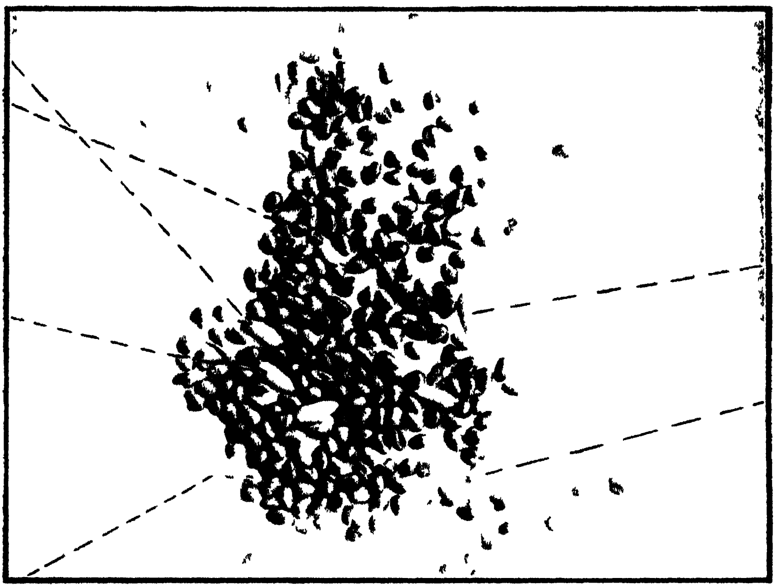
(2) At the apex of the "seeds" are attached numerous hairs, which enables them to be blown about by the wind.

(3) They are carried down stream by flood-waters, and deposited on the banks of rivers, where they germinate and form new infected areas.

The following results show the germinating capacity of the "seeds":—

No. of Seeds Planted.	Date Planted.	Date Radicle Appeared.	Date Cotyledon Appeared.	Percentage of Germination.
100	21st July, 1921	14th August, 1921	17th August, 1921	89 per cent.

The "seeds" were sown in sawdust on the 21st July, 1921, and placed in the green-house. The radicle began to appear twenty-one days after sowing (Plate II, Fig. 1) and the cotyledons twenty-seven days after planting. The cotyledons are green in colour, about ¼ inch



[Photo by E. P. Phillips.

PLATE I.

"Achenes" of "Corsican Thistle" (*Carduus pycnocephalus*, L.) in Clover Seed.

long, ovate, smooth. The plumule appeared two days later than the cotyledons (Plate II, Fig. 2), and the first leaves were produced five days after the appearance of the plumule (Plate II, Fig. 3). The first leaves are oblong, spiny, with a rough surface. These seedlings were planted in the garden of the Division of Botany; a few plants flowered and set seed the first season, while others were in the rosette stage. The radicle leaves die down during winter and start a fresh growth after the first rains in spring.

The plant is an herbaceous annual or biennial. It grows to a height of about 3 to 5 feet (Plate IV). During the first season the plant produces a deep tap-root crowned with a large tufted spreading rosette of leaves which are usually from 3 to 15 inches long (Plate III).

The upper surface of the leaf is deep green in colour and rough with minute spinelike hairs; the underside is grey and woolly (Plate V).

The stem is furnished with narrow irregularly lobed spinous wings. The flower-heads are thistle-like, small in size, pink to purple in colour. They are borne in clusters at the ends of the branches and stems (Plate V). The individual flowers are enclosed within this head; they are numerous, tubular in shape (Plate V, Fig. 2). The whole head is surrounded by a covering of numerous oblong-acuminate, spiny bracts (Plate V, Fig. 3).

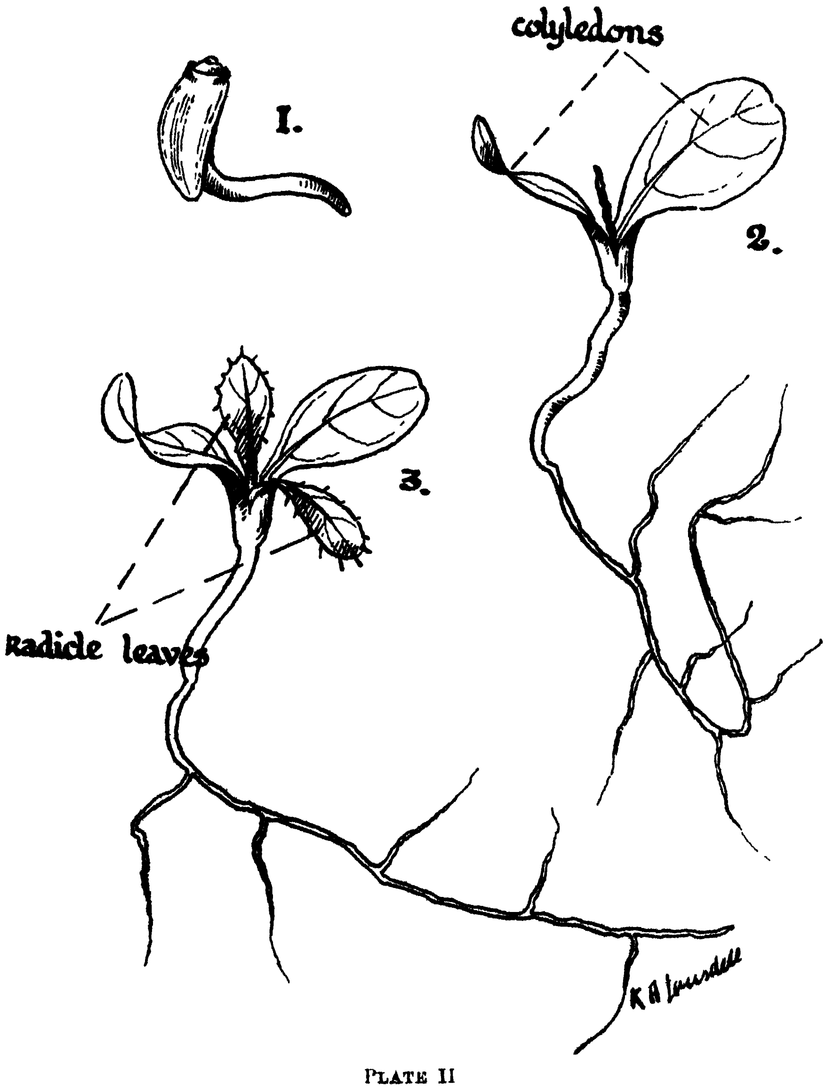


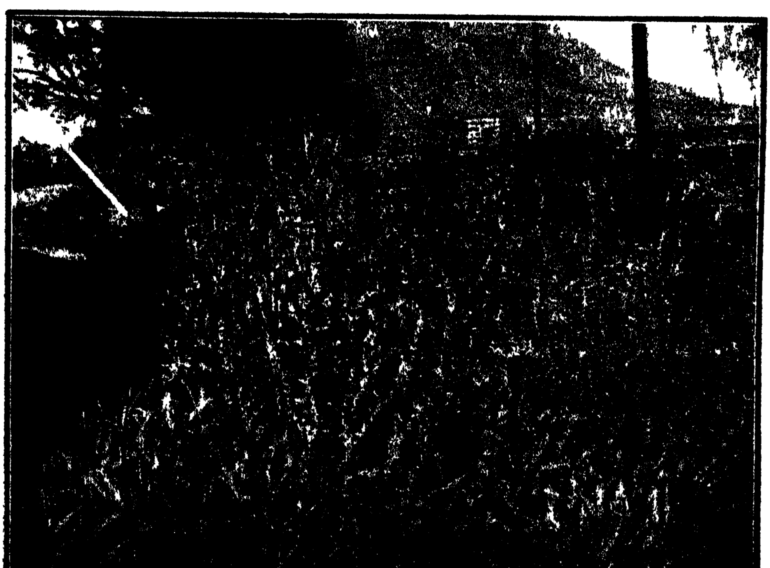
PLATE II

Fig. 1. Germination.—Fig. 2. Seedling, 17 days old.—Fig. 3. Seedling 2-3 weeks old. (*Carduus pycnocephalus.*)

[Photo by K. A. Lansdell.

PLATE III.

Plant grown from seed, Division of Botany, Pretoria, 16 months old. (*Carduus pycnocephalus.*)

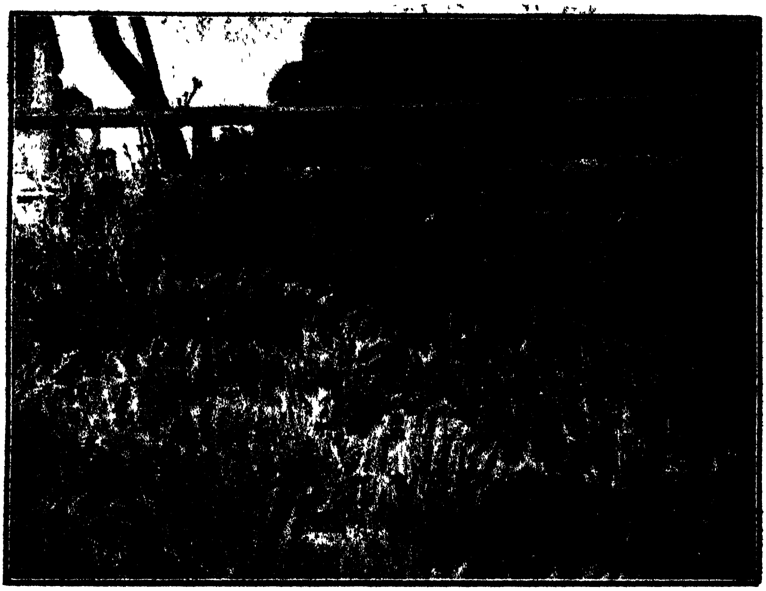


[Photo by K. A. Lansdell.

PLATE IVA.

Eradication.—Hoe-cutting the first-year rosettes; cultivation of the ground at once destroys these plants, never allow the plant to set seed.

The "Corsican Thistle" is not a proclaimed noxious weed in South Africa (at date of publication).



[*Photo by* V. *Putterill.*

PLATE IVB.

Plants growing along fence of railway line amongst "Wild Oats," Mowbray, Capetown. (*Carduus pycnocephalus.*)

Summary of information for use in the recognition of the weed, dissemination, and eradication:—

Vernacular name ...	The Corsican Thistle.
Scientific name ...	*Carduus pycnocephalus*, L.
Duration...	Annual or biennial.
Flower	Thistle-like, purple in colour.
Leaf...	Dark-green in colour, underside grey, woolly, spiny.
Seed...	Oblong in outline, flattened, light-grey in colour.
Habitat	Roadsides, cultivated lands, water-courses.
Dissemination ...	Impure seed, wind, fodder, flood-waters.
Eradication	Hoe-cutting of first-year rosettes; cultivation of the ground destroys these plants; never allow the plant to set seed.

PLATE V.
Fig. 1. Portion of plant.—Fig 2. Floret (enlarged).—Fig. 3. Bract (enlarged).
(*Carduus pycnocephalus.*)

XX.

Weed No. 15.

THE "YELLOW STAR THISTLE," *CENTAUREA SOLSTITIALIS*, L.

Order *Compositae.*

THE "Yellow Star Thistle," botanically known as *Centaurea solstitialis*, L., is a native of Europe, North America, and Western Asia. It is a weed of recent appearance in South Africa, and has only been recorded here during the last ten years, and is usually found in cultivated and waste lands.

The "seed" or achene (Plate I, Fig. 1) is similar to that of the "Malta Thistle" (*Centaurea melitensis*, L.).

The "seeds" may be disseminated in various ways, e.g.:—

(1) At the apex of the "seed" are attached numerous hairs, which enable it to be blown about by the wind (Plate I, Fig. 1).

(2) As the plants grow in cultivated lands the "seeds" may be harvested with the crop and thus distributed to other districts.

(3) They are carried down stream by flood-waters and deposited on the banks of rivers, where they germinate and form new infected areas.

The following results show the germinating capacity of the "seeds":—

Number of Seeds Planted.	Date Planted.	Date Radicle Appeared.	Date Cotyledon Appeared.	Germinating Capacity.
50	22nd July, 1923	12th August, 1923	14th August, 1923	80 per cent.

The "seeds" were sown in sawdust on the 22nd July, 1923, and placed in the greenhouse. The radicle began to appear eighteen days after planting (Plate I, Fig. 2), and the cotyledons twenty days after planting (Plate I, Fig. 3), and are green in colour, about ¼ inch long, spathulate, smooth. The plumule appeared one day later than the cotyledons, and the first foliage leaves were produced six days after the appearance of the plumule (Plate I, Fig. 4). The latter are oblong, spathulate, and serrate along the margins. Seedlings were planted in the laboratory grounds, and they flowered during the months of November-February.

The plant is an erect rough rigid annual, and grows to a height of about 3-4 feet. At first the root is crowned with a large rosette of leaves, which vary from 1-4 inches in length. These are grey-green in colour, downy, and with the oldest leaves of the rosette deeply pinnatified (Plate II). From this rosette of leaves the main stem arises, and is stout, striate, rigid, with decurrent wings, cottony, and is much

branched from the middle upwards. The flower-heads are thistle-like, terminal, solitary, large, bright yellow in colour; the involucre is ovoid or nearly globular, and is composed of numerous spiny bracts of various shapes. The inner bracts have a jagged scarious appendage at the tips: the intermediate are armed with rigid yellow divergent

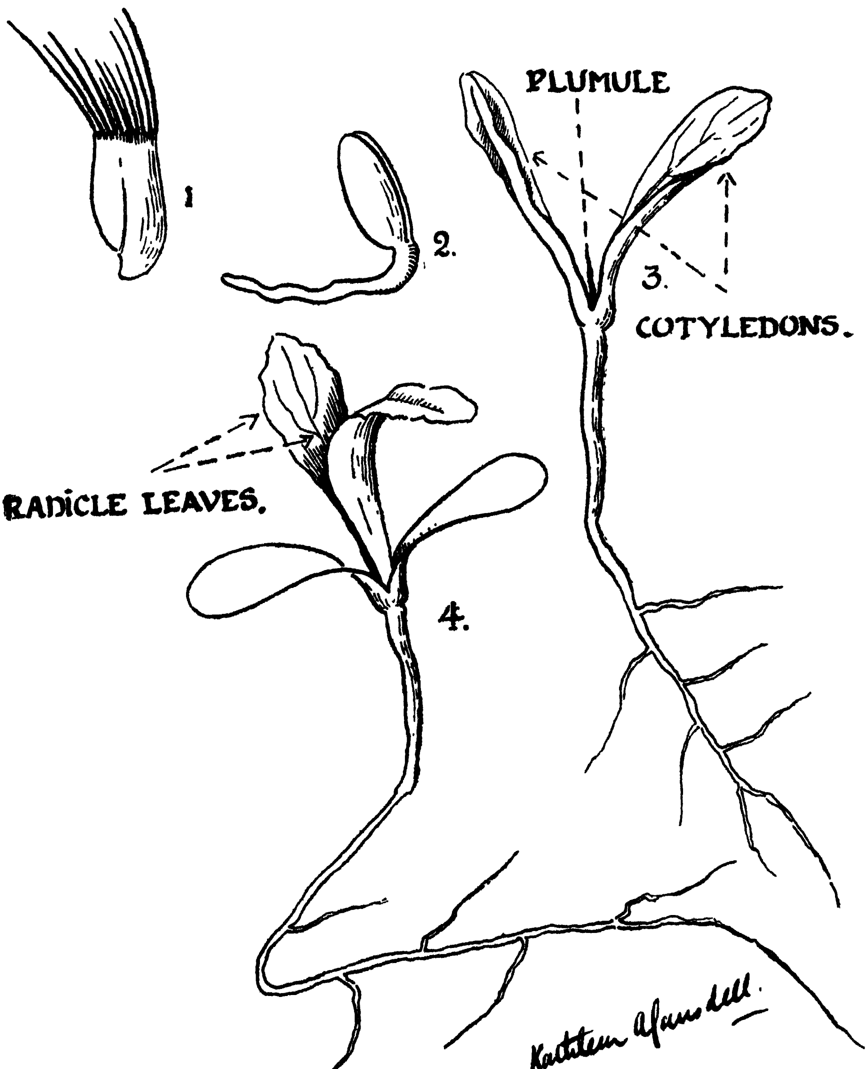
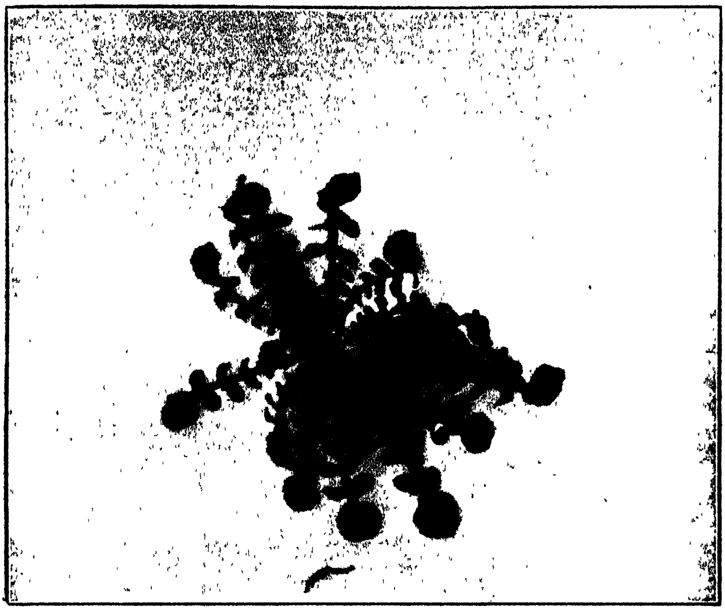


PLATE I.—Fig.1.—"Seed" (achene) (enlarged). Fig. 2.—Cotyledons (enlarged). Fig. 3.—Seedling showing cotyledons and plumule (enlarged). Fig. 4.—Seedling (enlarged). *Centaurea solstitialis.*

spines nearly an inch long, with one or two shorter ones at the base, and the outermost have short palmately branched spines (Plate III). The individual flowers of the head are numerous, tubular in shape and yellow in colour (Plate IV).



[Photo by K. A. Lansdell.

PLATE II. Young plant in rosette stage. *Centaurea solstitialis.*

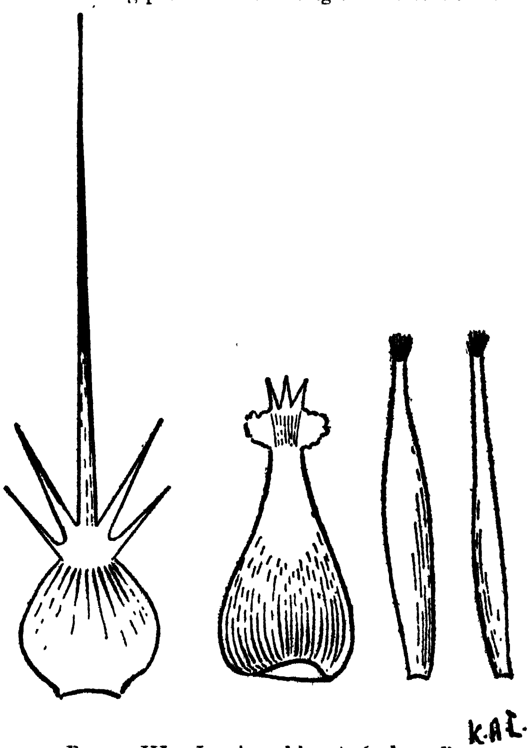


PLATE III.—Involucral bracts (enlarged).
Centaurea solstitialis.

Eradication.—Prevent " seed " production. As the plant is an annual, eradication should be attempted if possible by hoe-chipping in their rosette stage.

The " Yellow Star Thistle " is a proclaimed noxious weed in the Transvaal Province and in the divisional and municipal areas of Bedford and Jansenville (Cape Province).

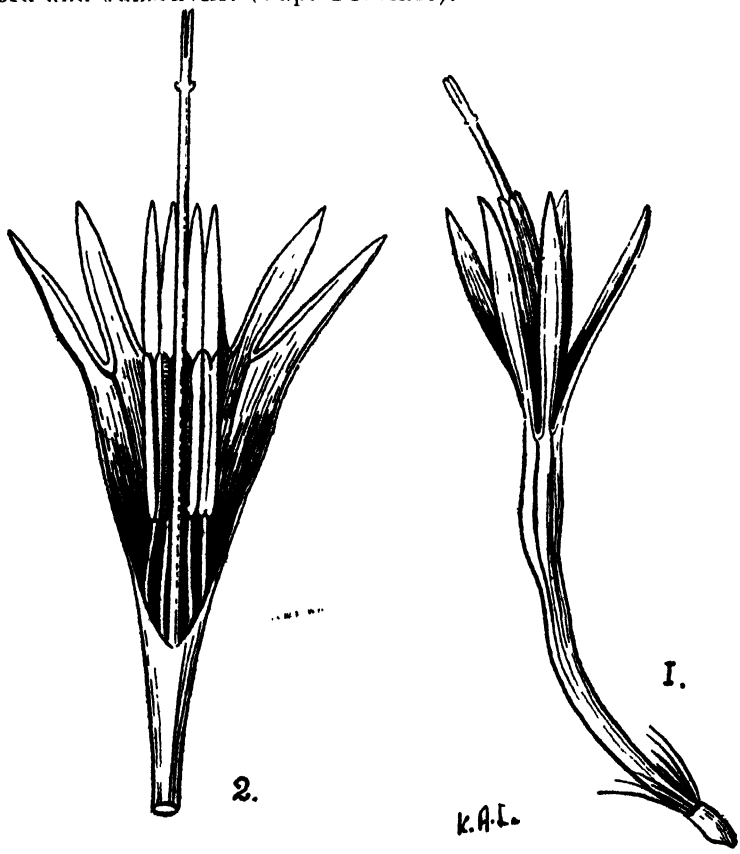


PLATE IV.—Fig. 1. Floret (enlarged). Fig. 2.—Floret opened, showing style and stamens (one stamen removed). *Centaurea solstitialis.*

Summary of information for use in the recognition of the weed, dissemination, and eradication:—

Vernacular name ...	"The Yellow Star Thistle."
Scientific name ...	*Centaurea solstitialis*, L.
Duration	Annual.
Flower-head ...	Thistle-like, yellow in colour, terminal, with large rigid yellow spines.
Leaf...	Grey green in colour, downy, irregularly toothed along the margin.
Achene	With apical hairs, beaked at the base.
Habitat	Cultivated lands, waste places.
Dissemination ...	Fodder, flood-waters, etc.
Eradication... ...	Prevent "seed" production, destroy plants in rosette stage.

PLATE IV.—*Centaurea solstitialis.*

FERTILIZERS AND FARM FOODS.

Unit Values of their Constituents.

By C. O. WILLIAMS, B.Sc., Chemist, School of Agriculture, Cedara, Natal.

IN the article by the writer, entitled "Manures and Farm Foods: Their Composition and Valuation," published in the *Journal of the Department of Agriculture* for September, 1924, lists of unit values of the constituents in fertilizers and foodstuffs, applicable to the different Provinces, were given. These lists were revised last year and published in the *Journal* for June, 1925, and in the table given below the values have been brought up to date. A full explanation of the methods adopted in the compilation and in the use of this system of units for valuing fertilizers and farm foods is given in the above-mentioned article.

I.—FERTILIZERS.

The values have been calculated on the net cash retail prices per ton, free on rail, usually at the port of landing or at the factory. For Natal, this is usually Durban or its neighbourhood. For the Cape Province, the quotations in almost all cases are free on rail at Capetown or the vicinity. As far as the Transvaal is concerned, there are very few firms quoting for delivery in large quantities from local stocks. Dealers in that Province seem to obtain their supplies largely through the port of Durban or from Durban factories, consequently the Natal retail prices, plus the railage from Durban to Johannesburg, have been taken as the bases for the calculation of the unit values for the Transvaal. It may be mentioned, however, that there are certain abattoirs in that Province offering meat and bone manures for which the unit values of the nitrogen and phosphoric oxide would work out

appreciably cheaper than the values given for these constituents in the Transvaal list below, which figures, as explained above, have been obtained entirely from the Natal prices.

There are only a small number of firms offering pure blood or meat meal, so it has not been possible to obtain stable and reliable figures for the unit value of organic nitrogen in such materials. From the few quotations obtained it is found that the unit value of the nitrogen varies from 12s. 6d. up to 26s., so it has been decided to take 20s. as an approximate unit value for the nitrogen in these materials. It is generally considered that nitrogen in the organic matter of bone is not so readily available as that in genuine blood or meat meal, but rather than assume a more or less arbitrary proportion of the unit value for blood-meal as the unit value for the nitrogen in raw bone-products, it has been resolved to give the same value for all the forms of organic nitrogen that are generally placed on our market. For this reason the unit value of the phosphoric oxide in bone fertilizers is a little lower than what it should be.

There are very few brands of raw mineral phosphates on the South African market, so no unit value has been calculated for phosphoric oxide in this form. It has been ascertained by parallel experiments in the laboratory and in the field that the citric-solubility of the phosphate in basic slag is a fair standard for the comparative valuation of the different brands of this class of fertilizer, but we have no satisfactory experimental proofs that the citric-solubility of the phosphate in ground mineral phosphates can also be taken for comparing closely their commercial values. Although this, in a measure, is also true of bone manures, we have, however, calculated the unit value of the citric-soluble phosphoric oxide in this class of fertilizers, and the figures might be usefully employed for a rough comparison of their market value.

Another arbitrary assumption is that the insoluble phosphoric oxide has half the value of the soluble phosphoric oxide in any particular class of fertilizer. This may be far from being true in the case of some fertilizers in actual manurial practice, but the assumption fits in very well with the actual prices charged by dealers for the various phosphatic fertilizers. If we take for granted this arbitrary proportionate value between the soluble and insoluble phosphoric oxide to be approximately correct in the case of all ground rock phosphates, the unit value of the citric-soluble phosphoric oxide in this class of fertilizers would come roughly to 4s. 6d. Comparative manurial trials carried out so far in this country go to prove that rock phosphates are a fairly good value at the prices they are quoted at the present time by the few firms offering them, and the probability is that the prices will come down lower still as the demand increases. They, moreover, have a higher percentage of phosphoric oxide than any other phosphatic fertilizer (except double superphosphate), and even if a fairly large proportion of this may not be immediately available to the crop it helps to build up the phosphate-content of the soil and also will gradually become available as time goes on.

It is again emphasized that a system of unit values such as given here is far from being a perfect method of arriving at the true value of a fertilizer, and a certain amount of caution must be exercised in its application. It may be assumed, however, that on the whole it furnishes a very useful method of arriving at a comparative valuation of the various brands of fertilizers of a similar nature.

TABLE OF VALUES.

Constituent.	Unit Values for.					
	Natal.		Cape.		Transvaal.	
	s.	d.	s.	d.	s.	d.
I. *Nitrogen*:						
(*a*) Nitric Nitrogen in Nitrate of Soda	20	0	19	0	20	9
(*b*) Ammoniacal Nitrogen in Sulphate of Ammonia	17	10	18	6	18	6
(*c*) Organic Nitrogen...	20	0	20	0	20	0
II. *Potash*:						
(*a*) As Chloride	4	2	3	9	4	4
(*b*) As Sulphate	5	6	5	6	5	10
III. *Phosphoric Oxide*:						
(*a*) Water-soluble Phosphoric Oxide in Superphosphate	5	0	4	4	5	8
(*b*) Water-soluble Phosphoric Oxide in Double Superphosphate	6	4	6	2	6	8
(*c*) Citric-soluble Phosphoric Oxide in Basic Slag	5	4	4	10	6	2
(*d*) Citric-soluble Phosphoric Oxide in Bonemeal, etc....	5	0	5	4	5	8

On comparing this table with last year's it will be noticed that the unit value of the nitrogen in sulphate of ammonia is appreciably less, while that in nitrate of soda has increased slightly. The figures for the various forms of potash and phosphoric oxide, on the whole, show little change.

II.—FARM FOODS.

Last year the value per food unit in the case of both vegetable and animal foods was practically the same, being about 1s. 4d. in each case. This year the average value per food unit of the concentrated vegetable foods (oil-cakes, etc.) works out to 1s. 3d., and in the case of animal foods (blood and meat meals) to 1s.

MERINO-WOOL CLASSING.

By P. D. ROSE, Lecturer, Sheep and Wool, Grootfontein School of Agriculture.

THE stable basis of the wealth of nations depends more than anything else upon the development of agriculture. As far as South Africa is concerned, it can be said without fear of contradiction that a great part of the wealth of our country depends on the development of its pastoral industries, the greatest of which is that of sheep husbandry. In spite of the importance of this class of farming, South Africa has in the past enjoyed anything but an enviable reputation with regard to her wools, and rightly so; the marketing methods practised were anything but desirable, and in a good many instances anything but honest. This may be attributed to the fact that wool to the farmer and to the up-country storekeeper alike was simply wool, and irrespective of its merits was sold at a standard price per pound. The stigma on South African wools or "Capes," as they are known on the London market, is, however, fast being removed, and our wools are at last coming into their own. But there is room for much improvement in the " get-up " of our country's production as a whole, and in the quality and quantity thereof.

The ultimate success of the sheep and wool industry depends upon:—

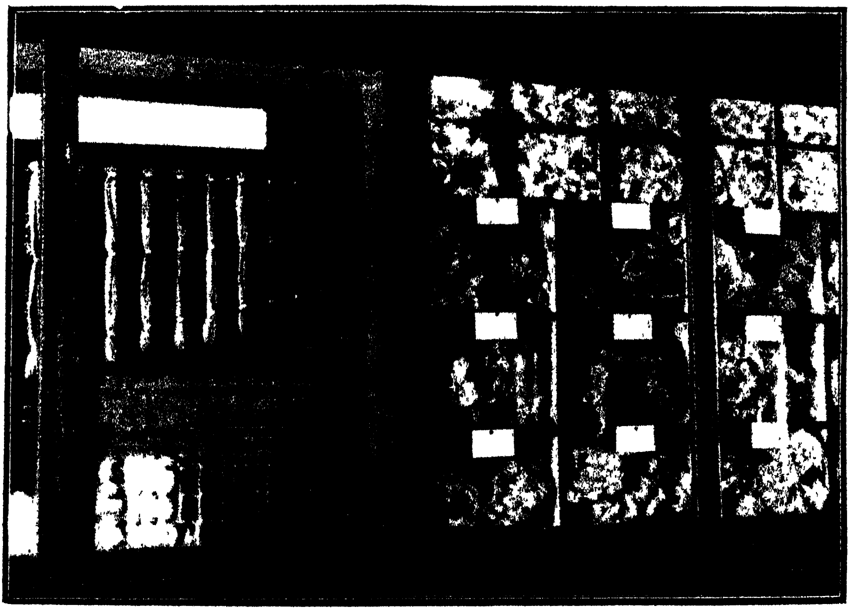
(1) the individual efforts to improve;
(2) the application of scientific knowledge to the sheep industry;
(3) the standardization of wool for marketing;
(4) the revising of existing selling methods; and
(5) the voluntary organization of farmers for business on co-operative lines.

The Government, through its Department of Agriculture, realizes the vital importance of this great industry and is doing all in its power to forward its interests, but without individual effort on the part of every farmer it can never hope for real success.

Advancement is the order of the day, and old farming methods must give way to new. Science has revolutionized all productive industries within the last half century. It has revolutionized the sheep industry in this country within the last fifteen years, and its continued application is as essential as food and clothing are to the human being. It is the fulcrum of all improvement, the pivot on which industrial advancement turns. It cannot be denied that the sheep and wool industry of this country is alive and growing, and that a very positive improvement has been effected in *numbers* and in quality and the production of wool per head of sheep; statistics clearly show this. But the need for scientific application only becomes greater as advancement continues.

We are undoubtedly approaching a period of more exacting demands which, in effect, means standardization. Standardization embraces roughly the selection and setting up of standards for quality,

shape, size, and other properties of materials and products. It is admittedly a very complex problem when wool is handled, the reason for this being the great variation which occurs in diameter and length of fibre, yield, etc. Nevertheless it is possible to set up a classification for one or two important factors at least in a sufficiently comprehensive form to enable the grower to grade his wool in such a manner as to be acceptable to the trade. The United States Government recognizing, from the economic point of view, the importance of uniform standards or grades is at present actively engaged on developing and promulgating standards for wool within its borders, and is at the same time co-operating with Great Britain with a view to correlating the United States standards with those of Great Britain. We in South Africa are in the fortunate position of having our whole clip Merino, consequently the development of a



Section of Glass Cases in the Wool Museum, Grootfontein School of Agriculture.

classification which would make grades acceptable to the trade is a comparatively simple matter. Standardization has worked wonders for our overseas egg trade, and its application to wool must come sooner or later. Wool growers' associations have already made a very spirited attempt in this direction with unqualified success, and it is hoped that as the number of these associations increases, the standardization of our entire production will eventuate.

Much has been done to educate the farmer and improve the industry at the growers' end, but so far little or nothing has been done to improve our marketing methods. Our acreage in comparison with our production is, unfortunately, out of all proportion. Consequently, instead of having one or two big selling centres where open competition would obtain, wide distances necessitate the existence of many, eliminating much of the competition. Distance, railway facilities,

etc., render it well-nigh impossible to remedy this condition, but there certainly remains much room for improvement in the actual methods of sale. It is a question which requires the producer's serious consideration. Open competition by means of auction sales is the best means of disposal, as they provide a healthy stimulus to prices and eliminate to a large extent the possibility of pushing through "dud sales." Let us take pride in the preparation of our wool, and then sell it to the best advantage by sending it to our biggest market, there to be disposed of by public auction. Why allow the speculator buyer, who often does not even handle the wool, to take a share of our legitimate profit? In many instances economic reasons necessitate the existence of an intermediary between the primary producer and manufacturer, but the production of wool in this country is yet far too small to support an unnecessary number of middlemen.

Much study of late years has been given to the question of wool classing, and great improvement has been effected. Many farmers are to-day preparing their wool in a most creditable manner, whereas only a few years ago these same men knew little and would have less to do with any form of wool classing whatsoever. It is maintained by some that a little knowledge, with a fair amount of common sense, is all that is required in wool classing. This fallacious reasoning has been responsible for the bad name associated with South African wools, and for the loss of a considerable amount of revenue, both to the individual and to the country. The case would, perhaps, be more aptly stated if it were said that a considerable amount of knowledge with a little common sense is all that is required in wool classing. "Knowledge is power" and the more our farming population takes this axiom to heart the greater will be the benefit to South Africa.

MERINO-WOOL CLASSING.

There is a certain amount of misunderstanding as to the exact meaning of wool classing, for many people talk of sorting and sorted clips instead of classing and classed clips.

Wool Classing.—Classing is performed in the shed while shearing is in progress, and means the allocating of whole fleeces or parts thereof, after skirting is completed, into various grades or lots, which lots are subsequently baled separately.

Wool Sorting.—Sorting, on the other hand, is performed in the mills, and means the dividing up of the contents of a bale and individual fleeces (if they can be found) into groups of staples according to their spinning properties, taking into consideration fineness, length, soundness, etc.

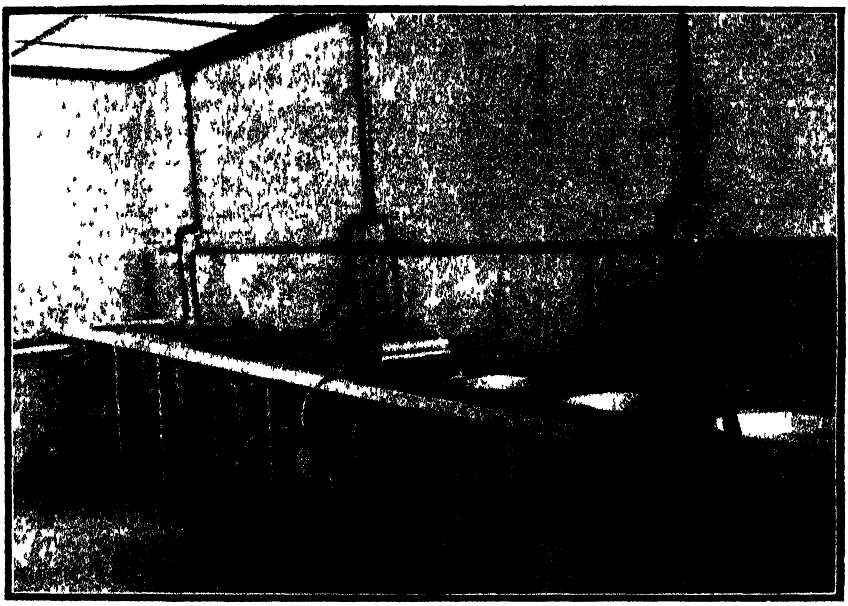
This work is performed by a specially trained body of men known as "wool sorters," who, by means of constant handling and long experience, have become familiar with the different wools and have developed that sensitiveness of touch and keen judgment in diameters of fibres so necessary in their work. The ability to distinguish between fine, medium, and strong wools does not qualify any one as a wool sorter. Farmers are not capable of doing this work, and even were they able to do so, it is doubtful if it would be a profitable undertaking The manufacturer makes particular standard sorts, the quality of which he must maintain at all costs, consequently

at best he would have to have the wool "looked over" again before allowing it to go forward to the blending department or scouring bowls.

Wool classing is not a highly complicated business, but knowledge of the manufacturer's requirements is most essential for the grower to be able to present his wares in the most marketable form. Highest prices are always realized for those products which approach most nearly the requirements of the purchaser.

PRELIMINARY SHED WORK.

In order to facilitate good classing it is essential that the preliminary operations of shearing, picking up, throwing, and skirting be properly and thoroughly done, otherwise no classer can do justice to the clip. Fleeces, unfortunately, vary in length even



Corner of the Scouring Room, Grootfontein School of Agriculture.

on the best of sheep, and bad shearing only increases this irregularity. Slovenly shearing inevitably means broken fleeces, which result in bad "picking-up" and "throwing-out." The latter results in loss of time on the skirting tables and bad skirting. Indifferent skirting has its inevitable consequence in poor classing. The "skirters" are largely responsible for the honest "get-up" of a clip.

Skirting.—The operation of skirting may be described as the removal of those portions which are inferior to the bulk of the fleece, with the object of improving it, while the fleece is lying spread open on a table provided for this purpose. It is a necessary operation, since in the individual fleece we find variations in length, diameter of fibre, tensile strength, colour, condition, and freedom or otherwise from burr, etc. Those portions which are removed are called "skirtings" and generally consist of the crow's nest, short cheek wools, rough neck folds (if any), sweat locks, and short edges from

forearms, belly and flanks, short hairy britches, and, if necessary, the back. The men who perform this work are called "skirters," and a considerable amount of judgment on their part is necessary, because each fleece has not only to be treated on its own merits, but in relation to the whole clip. For example, fleeces of varying length, fineness, colour, etc. (no matter how good the sheep may be), are continuously coming forward, consequently the skirter must decide on and remove immediately those portions which differ from the bulk. No law as to the exact amount to be removed from each fleece can be definitely laid down, but it soon becomes obvious to the intelligent skirter that a third grade fleece cannot possibly be treated in the same way as a first-grade fleece. Each fleece must, therefore, be treated on its own merits entirely. There is yet a further point to consider, namely, the size of the clip, for it must be obvious that a small clip cannot be so heavily skirted as a large one.

If, then, it is impossible to say exactly how much must be removed from each fleece, it is also impossible to say in what proportion the "out-sortings" must be in relation to the fleece lines. Circumstances alter with different cases, for in a "seedy clip" the out-sortings must of necessity be greater than would otherwise be the case. As will be observed later when individual clips are being dealt with, the number of lines made should not result in the clip degenerating into many small lots. Everything is a matter of proportion, and no amount of explanation on paper will teach any one to skirt judiciously.

ROLLING.

When skirting is completed, it is then the duty of the skirters to "roll" the fleece, and this operation may be described as the folding together of the fleece, or parts thereof that remain, into a convenient bundle which may be easily handled and shows the fleece off to the best advantage.

The usual method advocated, and described in most textbooks, is only recommended when fleeces are prepared for show purposes, or when shed operators have unlimited time at their disposal. The method is beyond criticism, but it takes up rather more time than can be conveniently afforded in a busy shed. It is generally supposed that this method, which hides all the inferior portions (back britches, etc.) and exposes the best wool (shoulders) to view, considerably enhances the value of the clip. Certainly individual fleeces show up well, while they retain their identity in the shed, but when once they have left the classing table, find their way into the bins, thence to the bale to be tramped or mechanically pressed, and are subsequently dumped for shipment, they lose both their "showiness" and their individuality. Any sorter knows full well that it is almost impossible to remove intact entire Merino fleeces from a bale, and to open up a fleece in such a manner as will enable him to distinguish between the various parts, shoulders, britches, etc. In individual instances this may be possible, but no sorter engaged on "Merinos" has the time or the inclination to do so, for he is generally paid per pack of 240 lb., and therefore gets through as much wool in the course of a day as possible.

Furthermore, when wools are opened up for sale at the coast, individual fleeces are not extracted; buyers simply take "pulls" until they have enough wool to handle for estimating purposes.

They are certainly not particular about finding whole fleeces and gazing at shoulder wools, but are rather more interested in inferior portions, if they can be found.

If the skirting has been thoroughly done, there should be no reason for "rolling in" inferior portions, as these should have been removed. All that is necessary in the shed is to roll the fleece with the flesh side out in such a manner that it will hold together in roll form to permit of its being conveniently transferred from the skirting table to the classing table, from there to the bins, and thence to the bale. If the fleece has been broken or cut up by heavy skirting, select a whole portion, put the remainder on this, and then roll.

The manner in which the wool goes into the bale is not so important as is the elimination of those portions which do not conform to the standard.

The above information is not given in order to encourage farmers to do the work in a slovenly manner, but rather to impress upon them the necessity of giving all available time to thorough skirting instead of wasting valuable time in making attractive rolls.

From the skirting table the rolled fleeces are transferred to a classing table, where they are placed ready to be examined by a classer. In our country, however, the clips are so small that full-time classers are not employed. The man in charge at the skirting table usually is responsible for the classing as well, consequently a classing table in such cases is unnecessary as the fleeces can be transferred direct into their respective bins.

Object of Classing.—Wool classing is performed with one object in view, namely, to put the maximum amount of money into the producer's pocket, and to attain it, the requirements of the trade must be studied; in other words, the grower must produee what the trade requires and present it in the form most pleasing to the buyer. Thus it is essential for the producer to have a working knowledge, at least, of the principles involved in wool classing. It is necessary, therefore, to discuss briefly the part that each of the five cardinal points, namely, length, soundness, fineness, colour, and condition, which are usually taken into consideration, play in wool classing and their usefulness in manufacture.

Length.—Length, which is usually measured over the thumb, is of the utmost importance in a shed, as it is one of the most desirable physical properties from the manufacturer's point of view. The greater the length the more easily can the fibres be controlled in the various machines, less overlap is required, and more twist can be inserted in spinning. Fewer fibres are required in the cross-section of a yarn to give the same tensile strength, and more twist gives a stronger, harder wearing thread, consequently lighter and more durable cloths can be made. Less overlap gives a smoother yarn with fewer joints, and the ultimate result is a more regular and saleable cloth. The cost of manipulation is considerably reduced, as owing to increased contact and frictional resistance less slipping and fewer breakages result. This means that bigger weights of yarn can be run off in less time.

While length is an important characteristic, a far more desirable feature for the manufacturer is regularity of length. Manufacturers have so perfected wool combs that they can manipulate

fibres of practically any length and can be set to take various lengths, but the comb has yet to be made that can effectively work simultaneously fibres of widely differing lengths. Length, as we know, varies not only in different breeds, or different sheep within the same breed, and in various parts of the same fleece, but even in the fibres that comprise the individual staple. We are not concerned with the first variation and can hardly remedy the last, but by judicious skirting and classing we can do much to remedy the others.

Length is readily seen and measured in the shearing shed while the fleeces retain their individuality, and it is therefore easy to remove those portions which do not possess the desired length and put fleeces of similar lengths together. When once, however, Merino fleeces have been baled, pressed, and dumped, it is almost impossible to sort for length. Manufacturers are aware that it is impossible to get or expect absolute regularity, but they do expect and certainly pay premiums for lines that possess this feature in the maximum degree. A variation in length of more than half an inch should be guarded against in the shed.

Soundness.—Soundness, meaning tensile strength, is usually tested in the shed in the following manner: A staple is drawn from the fleece and held at both ends between the thumb and forefinger of each hand. Tension is applied, and at the same time the middle finger is drawn sharply across the staple. If a metallic ring is obtained, the staple is sound enough for all practical purposes.

Each individual fibre, during the various processes of manufacture, is subject to a certain amount of strain, and if the strength of the fibre is not capable of withstanding this strain, fibre breakage results. Loss, therefore, is sustained, and the tensile strength of the resultant yarn and cloth is also seriously affected. It must then be obvious that unsound or "tender" fleeces must be kept apart from sound, healthy wools.

Fineness.—As with length, variations occur similarly in fineness. Fineness of fibre or smallness of diameter is one of the first essentials in manufacturing, for on fineness depends so many of the other desirable properties. It is common knowledge that fineness and shortness are correlated, i.e. if we breed for fineness, length must be sacrificed, and vice versa.

All things being equal, the finer the fibre, the greater the length of yarn that can be spun from a given quantity of wool, as fine wools are usually more highly or frequently crimped and are much more elastic and flexible.

It may be taken as an almost definite rule that, with an increased numbers of crimps, there is a proportional increase in the number of serrations or scale-like projections on the surface of the fibre. These projections are responsible for the adherence of one fibre to the other, consequently the value of fineness to the spinner is obvious.

Tensile strength is proportional to fineness, i.e. the finer the wool the greater the tensile strength per unit of diameter. As already mentioned, fine fibres cling together more readily, consequently on account of this and the greater tensile strength, a longer yarn of equal strength with a smaller diameter can be made than can be spun from a similar weight of coarser fibred wool.

More solid, compact, and level yarns can be made from fine wools, because the fine fibres lie more closely together. The finished article,

therefore, necessarily possesses greater tensile strength and wearing quality, in addition to a most desirable soft, full handle. For efficient classing it is desirable that growers should know the difference between fine and strong wools. The division of fleeces into lines of uniform degrees of fineness is desirable and in some clips possible, but the sub-division into uniform lengths is of far greater importance, as the manufacturer is better able to sort for fineness. It follows, therefore, that the same degree of care need not be exercised in classing for quality.

Coarse hairy wools of under 60's spinning count must in all circumstances be kept separate.

Colour.—Colour is of importance in that it affects the general appearance and attractiveness of the clip, but as differences in colour are largely due to colour variations in the yolk and the degree

Wool Weighing Pan, Wool Museum, Grootfontein School of Agriculture.

of foreign matter present, which can be removed by scouring, it follows that to the manufacturer such differences in colour are of minor importance. Variations in colour due to pigmentation or deleterious branding materials, on the other hand, are of such importance as to warrant the careful removal of all such wools. We all know the value of a colour scheme in window dressing, and matching for colour in classing renders the clip similarly attractive to the buyer. Lines should be made as even and attractive as possible, and discoloured, yellow, dirty, heavy fleeces should not be put with bright white fleeces.

Colour is easily seen, consequently if you are not sure, match it, and if it shows up badly try it in the next line; if still not satisfactory, put it on the cast line or break it up and run it in with the piece lines.

Condition.—Wools are generally spoken of as heavy or light conditioned, high or low yielding, as the case may be, depending on the amount of yolk, sand, dust, vegetable matter, and any other foreign matter that may be present. As only the pure wool fibre is of value, the amount of foreign matter in a fleece must therefore affect the price per pound. Wools of widely differing yields should never be baled together.

No definite rule with regard to classing for condition can be laid down. The best procedure to follow is to compare the fleeces for weight, and if the fleece is obviously heavier than those comprising the line on which it is desired to place it, put it on a lower line.

Heavy conditioned fleeces have a soddened, leaden heaviness, although the actual weight may be less than a big, bulky, light conditioned fleece, i.e. heavy conditioned fleeces have a much greater weight per unit volume.

Procedure in Wool Classing.—It is not possible to start classing immediately the first fleeces reach the classing table, unless the classer has an intimate knowledge of the particular flock, and even then it is advisable to allow about fifty or more fleeces to accumulate before classing is begun. The first "kraal" generally gives the classer a very good idea of the "run" of the flock. When classing is begun, take time about arranging the various lines, even if shearing has to be held up for a while. Due regard must be given to the number of lines it is intended to make, and the proportion between these lines. It is generally considered good practice to make the "top line" the biggest, and this is strongly recommended, but do not allow quantity to interfere with quality. Do not split up your clip into more lines than you can possibly help, i.e. do not try to make distinctions that do not exist, but, on the other hand, do not sacrifice what might be made into two even lines to make a single bulky irregular line.

If two lines that are obviously distinct can be made without "star lots" resulting, by all means make them. A star lot means any one fleece line consisting of less than four bales.

It is difficult to examine and price carefully numerous odd small lots, and it is for this reason, in addition to many other minor, but nevertheless annoying, difficulties that arise when numerous small lots have to be purchased to fill an order, that buyers object to small lines. To price wool correctly is always a difficult business, but it becomes more so when irregular lines are presented, for it must be remembered that the whole of the contents of a bale, or the line, is not open to view. The estimate must be made on guesswork, and consequently where irregularity exists a conservative bid is bound to be the result. Some buyers want fine short wools, and others long coarser wools, to suit their particular requirements. Thus when mixed lots must be purchased to fill orders, extra capital has to lie idle until such time as the wool can be sorted and the qualities not wanted sold again.

Regularity is of far greater importance than bulk. Two or more regular small lines make a bulky regular line. It is impossible always to maintain absolute regularity, for so much depends on the size of the clip; i.e. in small clips of 10-15-20 bales, it is absolutely impossible to avoid a certain amount of irregularity, because the limited number of bales naturally limits the number of classes that

can be made. For this reason it is always more difficult to class a small clip correctly, for in such instances bulk must be studied at the expense of regularity.

No hard and fast rule as regards the number of lines can be laid down in classing; so much depends on the merits of each individual fleece and the regularity and size of the flock. Definite recommendations regarding the treatment of various sized clips cannot be made, but the following may be taken as a general guide:—

FIVE-BALE CLIP.

Two classes only should be made, namely, (1) a fleece line, (2) locks and stains. The skirting should be very light, in fact little more than locks and stains should be removed. All fleeces should be classed together, with the exception of very short, badly coloured, and heavy fleeces, which should be broken up and run in with the locks. The "locks and stains" in this instance will be slightly better than in a larger clip. If necessary very inferior, short, dirty backs can be removed and run in with the locks. Bellies should be skirted in the usual way and run in with the fleeces. Short inferior bellies must be treated in a similar manner to short dirty fleeces.

TEN-BALE CLIP.

Three classes recommended: (1) A line of fleeces, (2) a line of bellies and pieces, and (3) a line of locks and stains. Slightly heavier skirting can be done in this instance.

Obviously heavy, short, and discoloured fleeces must be broken up and run in with the bellies and pieces. Exceptionally good bellies can be classed with the fleeces, but, generally speaking, should be kept separate from the fleeces and run in with the bellies and pieces, while very inferior bellies must be run in with the locks.

Backs, unless very inferior, should not be removed; if taken out, they should be run in with the bellies and pieces or locks and stains, depending on the class to which they are best suited. Very tender wools should be taken out, broken up, and run in with the bellies and pieces. Hoggets wool should not be separated, but worked in with the fleeces.

In this case the locks and stains will be inferior to that of the five-bale clip, while the fleeces will be superior owing to the existence of an intermediate line (bellies and pieces) in which wools that do not suit either the fleeces or the locks and stains can be put.

FIFTEEN TO TWENTY-FIVE BALE CLIP.

Four lines recommended: (1) A line of first fleeces, (2) a line of second fleeces, (3) a line of bellies and pieces, and (4) locks and stains.

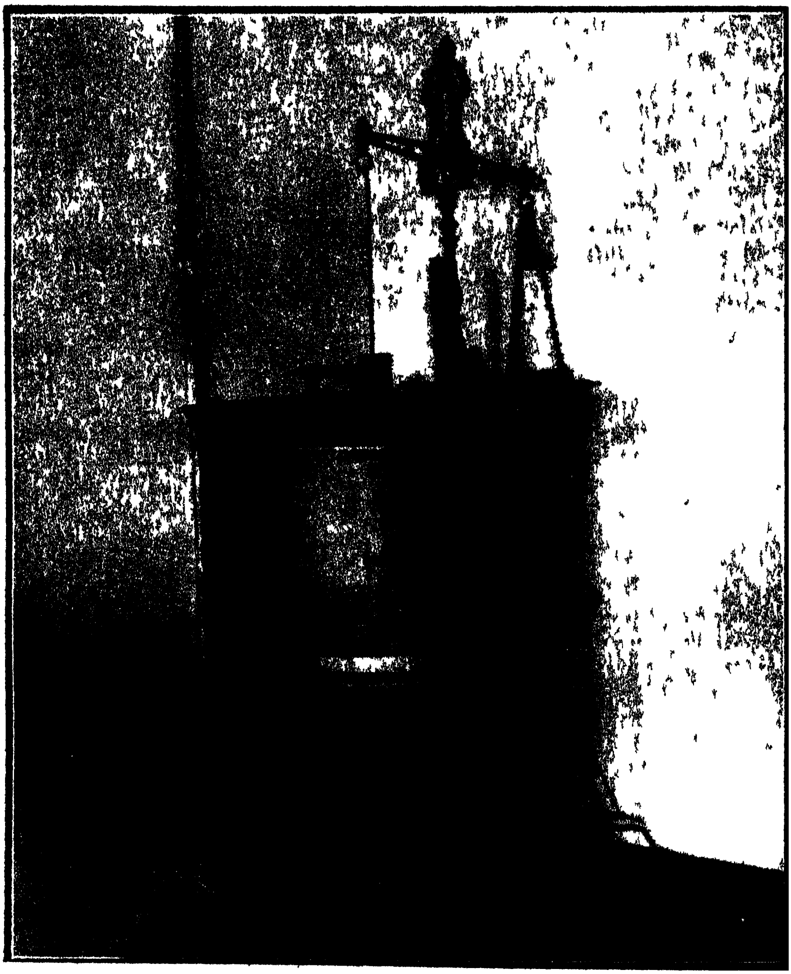
All first fleeces should be skirted slightly more heavily than previously, whereas the second fleeces can still be treated very lightly. Clean, short backs should be removed from the first fleeces and run in with the second fleeces. Dirty backs should be classed with the bellies and pieces or locks and stains, while tender fleeces must be treated as previously recommended. Bellies must be run in with the bellies and pieces, and inferior bellies with the locks. Short, inferior fleeces, too bad for the second fleece line, must be broken up and run in with the bellies and pieces or locks and stains.

In this instance the bellies and pieces will be superior to that of

the previous clip, owing to the slightly deeper skirting. The locks, too, will be superior, as all dirty, short bellies that do not suit the bellies and pieces line must be classed in this line.

THIRTY TO FORTY BALE CLIP.

Five lines recommended: (1) A line of first fleeces, (2) a line of second fleeces, (3) a line of first bellies and pieces, (4) a line of bellies and pieces, and (5) locks and stains.



Conditioning Oven, Wool Scouring Room, Grootfontein School of Agricultur

Slightly heavier skirting can be practised; backs, too, can b removed more freely and treated as previously recommended. Al fleeces that do not suit either of the fleece lines should be broke up and run in with first bellies and pieces, or bellies and pieces Tender wools should be treated as previously recommended.

In this instance the proportion of out-sortings (first bellies an pieces, second bellies and pieces, and locks and stains) to the fleec

lines will be rather greater, but the recommendation is made in order to prevent making a small third or cast line of fleeces. Well picked bellies and piece lines sell as well, if not better, than cast fleece lines.

If the flock is of a high standard, three lines of fleeces can be made in certain circumstances.

FORTY-FIVE AND OVER BALE CLIP.

This can be classed into as many lines as the classer thinks fit, and growers are recommended to follow, as far as possible, the standards as adopted by the wool growers' associations, bearing in mind the previous recommendations and avoiding the unnecessary splitting up of a clip into star lots.

For those farmers who already belong to wool growers' associations, or who intend taking this step, the following table is given in order to remove certain misunderstandings which have arisen in connexion with the classing standards adopted at the Wool Growers' Conference held in Middelburg, Cape, on the 22nd May, 1924:—

CLASSING STANDARDS.

Brand.	Class.	Description.
H.	Hoggets	Being genuine hoggets, i.e. sheep not previously shorn of 2½ in. and upwards.
SC.	Super Combing (ESC & SSC)	Consisting of all the lightest conditioned, sound, attractive fleeces of super quality, 2¾ in. or over (this line to be made only in large clips when numbers warrant it, and farmers desire it).
C.	1st Combing ...	Consisting of all the lightest conditioned, sound, attractive fleeces of good quality not under 2¼ in.
CC.	2nd Combing ...	Consisting of the heavier conditioned, less attractive, but sound, fleeces not under 1¾ in.
CCC.	3rd Combing ...	Consisting of short, very heavy, unattractive, discoloured fleeces not included in the above lines. If numbers warrant, this sort may be made; if not, these fleeces should be broken up and run in with the bellies and pieces.
LL.	1st Lambs ...	Consisting of the longest, lightest, and most attractive lambs wool, not under 1¼ in. in length.
L.	Lambs	All shorter and less attractive lambs wool. (*N.B.*—Very inferior lambs wool should be placed with locks.)
CBP.	Combing, Bellies, and Pieces	Consisting of the bulkiest, cleanest, lightest skirtings and bellies, and broken fleeces not under 1¾ in.
BP.	Bellies and Pieces	Shorter and heavier pieces and bellies.
LOX.	Locks	Locks and stained wools, exclusive of dags.
BKS.	Backs	Where backs are found to be very earthy, tender, or mushy, they should be taken out and baled separately. If clean and sound they must be left in, provided they match the fleece; if they do not, they should be sorted into the relative combing classes.
TDR.	Tender Wool ...	Keep separate or (*a*) run in with backs, (*b*) if whole clip be tender it should be classed on the same lines as a sound clip.
BUR.	Seedy and Burry Wools	Must be kept separate.
XM.	Coarse Merino ...	All wool below 60's quality.
RAM.	Rams	If rammy keep separate, otherwise run in with fleece lines.
DEAD.	Dead Wool ...	All wool taken from dead animals must be baled separately and branded as such.

NOTES FOR GUIDANCE OF CLASSER.

(*a*) The above table has been laid down as a guide to suit the bulk of South African wools, consequently it makes provision for all possible lines, but it must be understood that all the classes mentioned need not necessarily be made in one particular clip; the classer must use his own discretion, and endeavour to make not more than three combing lines. Too great stress cannot be laid on the inadvisability of making star lots in the combing lines, and if a four-bale lot cannot be made in any combing line, this line must be run in with the line immediately below and branded as such. Coarse merino and tender fleeces must not be considered as combing lines, and must be dealt with as laid down under the classification.

(*b*) All obviously heavy and discoloured fleeces should be put into a lower grade than that to which they would otherwise belong, provided they can be made to match; if not, they should be broken up and put into the bellies and pieces.

(*c*) In large clips the super lines may be divided into fine and strong, if at least five or more bales of each can be made; when this is done, the finer quality should be branded ESC and the stronger SSC.

(*d*) Clips under 600 sheep or fifteen bales should be classed as follows: (1) Combing, (2) bellies and pieces, (3) locks and stains, exclusive of dags.

In a good clip of 600 sheep it may be found expedient to make two lines of fleeces. Hoggets should not be separated, unless immensely superior to the rest of the clip.

(*e*) All the bales should be stencilled on one end only, that is, the stitched end, as illustrated:—

		MIDDELBURG W. G. ASSN.		← Name of Wool Growers' Association (if any).
		A. SMITH, Tafelberg.		← Farmer's Name and Address.
Description of Contents →		ESC — 20.		← No. of Bale.
Station No. or Code →	10/		BSP/P.E.	← Broker's Name and Address.

All bales to be numbered from 1 upwards, commencing with the top line.

(*f*) Only in exceptional circumstances should backs be removed from fleeces under 2¼ in.

(*g*) Always try and avoid the making of star lines in the combings, i.e. less than four bales.

(*h*) If whole clip is seedy and burry, it should be classed on the same lines as a free clip.

(*i*) Fine wool which might be slightly below the medium length, but shows exceptional qualities, may be put into a higher grade.

(*j*) The lowest fleece line in any particular clip should be cast line.

(*k*) All measurements given above are for unstretched wools.

(*l*) Sheep not to be branded with tar or paint; if so branded, these brands to be removed and run in with locks.

The classing standards as they appear were laid down by the trade representatives at the above-mentioned Conference. As these standards represent the requirements of the trade, farmers would be well advised to follow them.

The object of laying down certain definite standards for growers is to arrive at a certain amount of uniformity throughout the country. Uniformity of grading of any product is always an advantage to buyer, seller, and producer. As the movement spreads and buyers become familiar with the various brands, they will know exactly what wools to expect in a line having a particular brand, no matter where the wools are displayed for sale. Buyers can thus rely on every bale containing the grade represented by the brand. It is maintained by some that the grower who belongs to an association is handicapped because he cannot brand his top line (if it does come up to the standard) super fleeces, as he was in the habit of doing. This argument does not hold water. No buyer will buy locks for super fleeces, even though they be branded as such. He concerns himself with the contents of the bale, estimating the yield, examining the length, soundness, fineness, colour, etc., and will pay for what he finds, not for the brand.

The trade is well aware that it is impossible for every class to be made in one flock, and it was never intended that this should be the case, but where possible it is recommended for the reasons already enumerated.

The above classing standards can be made to suit the requirements of any shed. For example, provision has been made for a class of hoggets wool where numbers warrant this line being made, but there is no objection to hoggets wool being classified into the fleece lines, provided they are equal in all other respects. Similarly with the super combing line (SC), it is not recommended in big clips to divide this line into two, namely, extra special combing (ESC), consisting of fine and medium fleeces, and super strong combing (SSC), consisting of all fleeces of approximately 60's quality. This should be done where at least five or more bales of each line can be made; if this is not possible, ESC and SSC can be baled together and branded SC. In all instances where two or more lines are run together, they must be branded with the brand representing the lowest grade they contain, i.e. if long lambs (LL) are classed with lambs (L), they must be branded L; if first combing (C) is classed with second combing (CC), the bale must be branded CC.

The classer having decided on the number of lines, allocates the fleeces to their respective "bins," and proceeds examining each fleece for the various properties already enumerated, bearing in mind the standard on which he has decided.

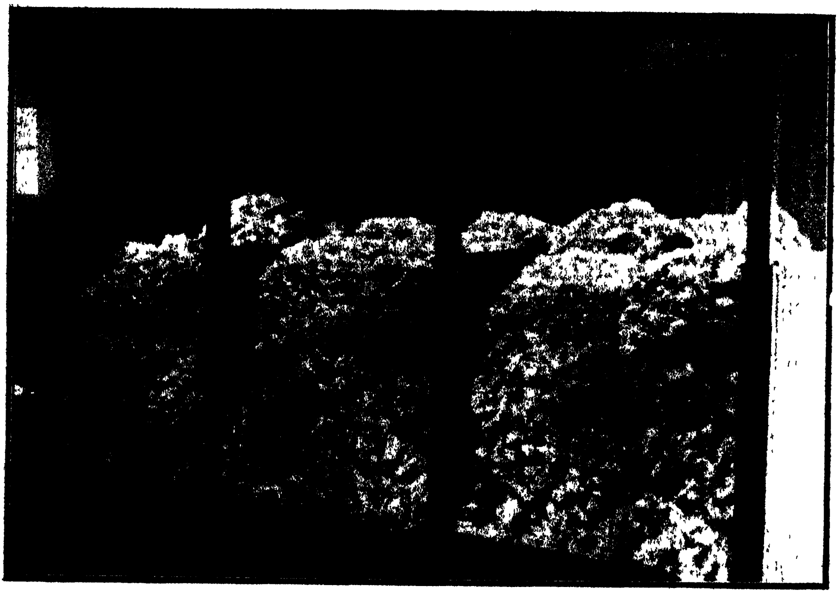
BINS.

Bins must be built large enough to hold a little more than the contents of one bale, and must be situated in as good a light as possible, and in such a position that the classer can at a glance see the contents of each. Their value in a shed cannot be over-estimated, because without them efficient classing is well-nigh impossible. No

wool-classer is infallible, and unless he has these bins, so that he can see the various fleeces together, and the lines side by side, it is more than likely that unknowingly he will gradually change his standard. Too great stress is often laid on the value of bins for cooling the fleeces, whereas their real value is overlooked.

Cooling.—Cooling is of little or no consequence, whereas comparison and reference are everything in wool classing, and bins alone make this possible.

Never bale the entire contents of a bin; always leave a few fleeces at least for reference so that the standard may be correctly maintained.



Wool in Bins, ready for Baling, Grootfontein School of Agriculture.

HOGGETS WOOL.

As is the case with lambs wool, true hoggets wool, i.e. the first clipping taken from a young sheep after the age of approximately eight months, possesses those most desirable characteristics, namely, softness of handle, elasticity, and pliability, in the maximum degree. These qualities, characterized by the springiness or "rise" so evident when this wool is being tramped, combined with increased yields and tensile strength, render it suitable for special uses. It is therefore in great demand and should, for this reason, be baled separately when in sufficient quantity to make a line; if not, it must be classified in the usual way and run in with the ordinary fleece lines.

LAMBS WOOL.

Lambs wool should in all circumstances be kept separate from the fleece lines. If numbers warrant it, it is advisable to make two classes, namely, first and second lambs; if not, only one line should be made.

In packing lambs wool, the longest and best coloured wool will constitute the top line. The second line will consist of the shorter and discoloured wool. When only one line is made, the very inferior fleeces must be run in with the locks and stains.

The work of picking lambs' wool will be greatly facilitated if the picker-up is instructed to remove the locks and short bits before the fleece is lifted from the floor with the lamb boards.

As the individual fleeces are deposited on the table, the "firsts," consisting of the bulky free wool of good length, colour, and quality, is picket out. The remainder, or seconds, is then picked over to remove stains and locks.

Lambs wool is often covered with coarse white hairs called mother-hair. These fleeces, though they appear much brighter than other lambs wool, should never be allowed to go into the top line, but should be kept in the "seconds." When only one line is made, very coarse, hairy fleeces, characterized by their dead whiteness, should be thrown into the locks.

PIECE PICKING.

This operation consists of classifying the skirtings, i.e. separating the locks and stains, the shorter and more discoloured bits of wool from the longer and brighter pieces. Where this operation is properly done, considerable profit is derived therefrom, and farmers are strongly advised to give this work their careful attention. False economy, that is, trying to save the wages of one or two natives, is usually responsible for the bad classification of the pieces. Pieces should never be allowed to accumulate in the shed, as this only results in hurried and slovenly work.

Sufficient labour should be continuously employed so as to keep pace with the skirters. The work is performed on a slatted table so as to allow the sand rubs, etc., to fall through. The table used for this purpose should be placed immediately in front of two or three fairly large bins, so that the various pieces can be thrown directly into their respective classes.

Where the estimated number of bales of bellies and pieces is approximately six to seven or more, and the wool warrants it, two lines can be made to advantage, the first to consist of all the longest, brightest, bulkiest, and best coloured wools. All inferior pieces should be classed in the second grade. Tensile strength is not taken into consideration, as it is impossible to test the numerous small pieces.

LOCKS AND STAINS.

Locks and urine-stained wool should always be kept separate from the rest of the pieces and can be baled together. Very hairy britches, cheek wools, and shankings go with this class.

Dags should be kept separate. Wet stained wool should be sun-dried before baling.

BELLY WOOL.

After the bellies have been removed they should be picked up immediately and taken to the piece-picking tables. Each belly requires light skirtings in order to remove sweat locks, etc., and stains in the case of rams and hamels, and classified in exactly the same manner as the pieces.

The question is often asked why bellies must be separate from the fleeces. Bellies are usually shorter than the rest of the fleece, inclined to tenderness, and often discoloured and seedy, consequently for all practical purposes it is safer and easier to keep them separate. There is, however, no objection to belly wool being run in with the fleeces, provided they are equal in all respects.

The practice is, however, not advocated.

SWEEPINGS.

As the name implies, sweepings consist of the shorter, dirtier wool and a considerable amount of sand. It is always good practice in a shed to sweep as often as possible, but never before all the larger bits of wool lying about have been picked up and taken to the piece-picking table.

As much sand and dirt as possible should be sieved out before the sweepings are baled. A conveniently cheap and easily made sieve suitable for this purpose can be made from half-inch wire-netting supported by one or two stiff steel wires.

Sweepings should always be baled separately.

BALING.

For preference use first-grade 12-lb. wool packs, and if the "all-wool pack" comes on the market, use that. If a proper wool press cannot be afforded, a suitable box press can easily be made. If a wool press is used the bales look much neater and the general attractiveness of the clip will draw the buyer's attention and inspire him with confidence.

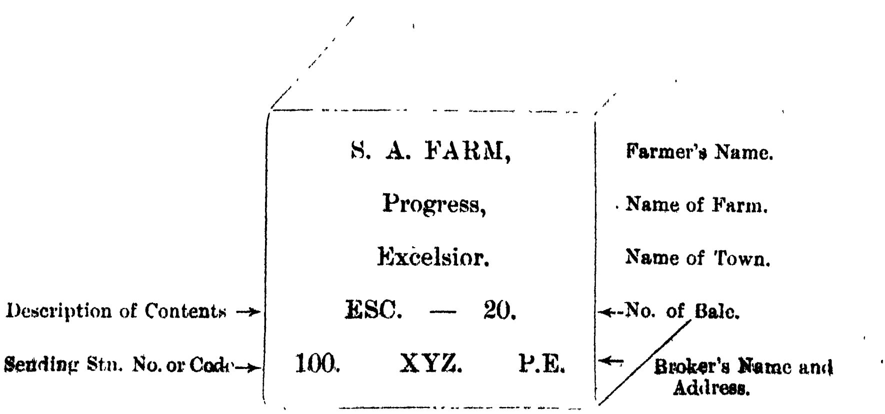
A wool press pays for itself within a very few years.

SEWING.

Use good, smooth stitching twine. Stitch neatly.

BRANDING.

Use stencil plates and brand on the stitched end of the bale. If you are proud of your wares and satisfied with your work you will not forget to put your name and that of your farm in big capital letters in the following manner:—



THE PEANUT IN SOUTH AFRICA.

By D. MOSES, M.Sc. (Agric.), and J. P. F. SELLSCHOP,*
Potchefstroom School of Agriculture and Experiment Station.

INTRODUCTION.

THE peanut, *Arachis hypogea*, the ground-nut of commerce, and in South Africa popularly known as the monkey-nut, is one of the world's best oil and protein crops. Formerly grown only by natives in this country, the crop is now being grown more extensively, especially in the Transvaal, the value of the peanut as a food for man and beast being recognized, as well as its use in the manufacture of oil, soap, and confectionery articles.

STATISTICS OF PEANUT PRODUCTION.

The total production in the Union during the seasons 1921-22 and 1922-23 was approximately eighteen million pounds of unshelled nuts. Of this quantity the Transvaal produced almost five times as much as the three other Provinces combined, Natal being second in production, and the Free State third. Production in the Cape Province is almost negligible.

The leading districts of the Transvaal are: Potgietersrust, Waterberg, and Pietersburg, each growing between 1,000 and 2,000 morgen of peanuts per annum. In the western Transvaal, Districts of Potchefstroom, Klerksdorp, and Zeerust over 1,500 morgen were planted in 1924-25. In this area the crop apparently does well, notwithstanding variations in rainfall, and appears to suffer less locust damage than many other crops. In Natal more than 200 morgen are planted annually in the Klip River and Dundee Districts. The Orange Free State does not grow more than 100 morgen annually.

PEANUT PRODUCTION IN THE UNION.

Year.	Acreage.	Unshelled Nuts. lb.
† 1917-1918	6,557	5,955,000
1919-1920	13,220	6,502,000
† 1920-1921	19,052	14,241,000
1921-1922	17,290	7,501,000
† 1922-1923	15,214	10,312,000
1923-1924	16,187	14,378,070

IMPORTS.

A considerable quantity of peanuts is imported each year, of which more than four-fifths comes from Portuguese East Africa and the remainder from British East Africa, China, India, and Japan. Imports are decreasing, but are still equal to from one-sixth to one-fourth the production of the Union.

* The writers wish to acknowledge their indebtedness to Messrs. T. D. Hall, A. R. Saunders, and R. O. Wahl for much valuable information given under the headings of Soil Fertility, Diseases, and Insect Pests respectively.

† Includes amounts grown in native reserves.

The following table shows the imports since 1913:—

Year.	Tons.	Value. £
1913	1,430	19,000
1914	1,454	18,000
1915	1,521	15,000
1916	2,092	24,000
1917	1,544	17,000
1918	1,753	23,000
1919	375	10,000
1920	948	27,000
1921	391	700
1922	749	27,000
1923	1,046	21,000
1924	631	13,000

FIG. 1.—Young peanut plant, showing habit of bearing and nodules on roots.

EXPORTS.

Peanuts are exported in small quantities principally to St. Helena, South-West Africa, United Kingdom, Germany, and the Belgian Congo. The following table shows the export trade since 1915:—

Year.	lb.	Value. £
1915	176,000	1,000
1916	22,000	3,000
1917	76,876	745
1918	856,000	6,000
1919	382,000	6,000
1920	58,456	1,276
1921	908,259	10,501
1922	24,000	260
1923	2,000	74
1924	28,000	255

DESCRIPTIONS AND CHARACTERISTICS OF THE PLANT.

The peanut is a summer annual legume, and is a bean rather than a nut, the shell being similar to the pod of a bean. The plant resembles a clover, but the leaflets, which have the sleep movement found in many other legumes, are four in number instead of three, and are arranged in pairs. The stems are angular, pale green, hairy, and upright in the improved types, but prostrate in the common ones. The height of the plant seldom exceeds 12 inches. The flowers, which are borne in the axils of the leaves, resemble those of the pea in shape, but are smaller and of a bright yellow colour. When fertilization has taken place, the peduncle (flower or fruit stem) elongates, bends downwards, and carries the sharp-pointed ovary below the surface of the soil, where the nut matures. The number of pods and kernels borne on any plant depends largely on the variety and environmental conditions.

CLIMATIC REQUIREMENTS.

The peanut requires a minimum frost-free period of five months, with an average summer rainfall of 20 inches or more, a fairly high temperature during the growing period, and dry weather during ripening and harvesting. If other conditions are favourable, good results may be obtained with as little as 10 inches of rainfall. In Senegal, for instance, large quantities are produced under a 10-inch rainfall. Large areas in the Union, particularly in the northern and western Transvaal, Natal, and the northern Orange Free State, appear to be suitable for peanut culture, and in these areas the crop is certainly worthy of a trial.

SOIL REQUIREMENTS.

The crop does best on well-drained soils of a sandy or sandy-loam nature containing a fair amount of lime and organic matter. A calcareous soil is not necessarily essential, but one in a suitable mechanical condition is desirable, with conditions favourable for nitrogen-fixing bacteria. Most light loams are suitable, but clay loams should be avoided if possible, as they are stiff and often acid;

furthermore, harvesting is more difficult on such soils, and the resultant crop cannot be easily cleaned of adherent soil. Clean, white nuts will often be produced on a dark, porous soil, while some light sandy soils will give reddish-coloured nuts on account of the presence of large amounts of iron compounds. This colour, though it does not affect the kernels, is discriminated against on the markets. The peanut has given the best results on land which has been well cultivated; it cannot be recommended as a crop for virgin soil. The coarse, porous "turfs" of the Waterberg District and the loose, sandy soils of the western Transvaal have so far proved to be the soils best suited.

FIG. 2.—Mature peanut plant.

SOIL FERTILITY.

Experience with regard to fertilizing the crop has been varied and conflicting. One of the few profitable results obtained from fertilizing has been with 300 lb. of superphosphate and 600 lb. of limestone per acre; this was on a soil which had plenty of lime and was in fact alkaline in reaction. The fertilizers were applied in the rows, and the benefit of the lime apparently was that it prevented the superphosphate from burning the germinating peanuts. The peanut seedling is most sensitive to fertilizers, and these should be broadcasted and harrowed in before planting, or the delivery tubes of the fertilizer attachment should be so set that the fertilizer is dropped two to three inches to the side of the nuts.

Where peanuts form the main crop and it is not practicable for the soil fertility to be maintained by fertilizing the other crops, try, with the above precautions, 200 lb. per acre of a mixture of two parts superphosphate and one part rock phosphate or four parts superphosphate and one part bone-meal. With this try 60 lb. per acre of muriate of potash and 500 lb. per acre of ground limestone, both together and separately. This is the only way to ascertain if the addition will pay. As this is a legume crop, it fixes its own nitrogen, and none need be applied. No crop of nuts has yet been noticed whose roots were not well covered with nodules, so that the inoculation of the soil or the seed with bacterial cultures cannot be recommended.

FIG. 3.—Stack of peanuts ready for packing.

Although this plant fixes much nitrogen, most of it goes into the kernel, so that when the whole plant is harvested the soil does not benefit much. Tests at this institution have shown great benefits to maize following cowpeas and tepary beans harvested, but none from maize following peanuts harvested in the ordinary way. The present method of handling peanuts cannot be said to improve the soil fertility at all, and unless animal manures are applied somewhere in the rotation another legume such as velvet beans, mung beans, or cowpeas may be necessary to maintain the soil in good fertility.

SEED SELECTION AND PREPARATION.

The best seed obtainable should be used in order to secure good, even stands and to obtain maximum yields. Poor seed gives poor stands. There are certain growers who can supply well-graded seed of a good strain. The best method, however, of obtaining seed is to practise field selection and grow a seed plot. Select vigorous, healthy plants which are surrounded by a good stand of other plants, with many pods and tough peduncles. Avoid plants with sessile flowers and " dud " or blank pods. The seed must then be sorted and freed from trash, properly graded to uniform size, and shelled, care being taken not to break the papery covering or testa of the kernel. In certain localities it is evident that deterioration of varieties has occurred, probably due to little care being given to the question of seed. As the shelled seed is liable to deteriorate and to become rancid, it should not be stored for too long a period, and must be kept in a cool, dry place.

SOIL PREPARATION.

The land should be as well prepared for the peanut as for root crops or maize. Deep ploughing and fallowing to destroy volunteer peanut plants and weeds and conserve moisture will be found desirable, especially in the drier areas. Disking or harrowing should then be done to prepare a fine seed-bed.

PLANTING.

The seed can be planted, shelled or unshelled, behind a plough or in shallow furrows drawn with a marker. If planting behind the plough, the land, of course, must be harrowed after planting. It is, however, much more satisfactory and economical to plant shelled seed by means of a maize-planter using specially made extra thick iron, hickory, or plywood plates in the seed-bins. If many broken seeds are obtained in the planting process, although the special peanut plates in the seed-bins are being used, the shoe string beneath the hopper in the seed-bin may be cut in half and a half spring used in each bin. This halving reduces the pressure on the seeds passing through the plates. There are several planter attachments on the market, such as special plates, false plates, and seed elevators, for certain types of bins, but none is more universally used than the home-made plate. Some growers have even devised and made successfully their own planters. Where labour is plentiful and cheap, large areas are still planted by hand.

Planting generally takes place during October and November. In most areas later planting will give reduced yields: 28 to 32 lb. of shelled nuts and 45 to 50 lb. of unshelled nuts will usually be sufficient to plant an acre. The exact amount used will vary according to the variety and the spacing adopted. Spacing, which depends on soil and climatic factors, is important and should be determined locally. In areas of good rainfall 28 inches between the rows is wide enough, while in drier parts up to 36 inches will be necessary, the plants being spaced from 5 to 12 inches in the row respectively. In dry soil the seed should be covered to a depth of 2 inches, whereas in a moist soil a depth of 1 to 1½ inches will suffice.

SUBSEQUENT TREATMENT.

Harrowing or cultivation, preferably the latter, may be started as soon as the plants appear above ground and continued until the blossoms fall and the nuts begin to form or "peg." Ridging is not always necessary, although a moderate amount of earthing up or working the soil towards the rows ensures the penetration of the peduncles with the fertilized ovaries and later facilitates the lifting of the plants. If the soil around the plants is hard, the "peg" may fail to penetrate and wither, and no nut results. Earthing up, as such, has proved both beneficial and detrimental. Whether earthing up can be practised or not depends entirely on the type of soil and the class of implement used. The heavier the soil the more earthing up will be necessary, while in very sandy soil it has been shown to be of little value. At all events, earthing up should not be done until the first crop of flowers has withered. Owing to the great variation in types of soil planted to this crop and the many different implements used, it is not possible to state definitely the number of cultivations that should be given in any area. Trials in the different areas will indicate the number required and the time of cultivations and the type of implement to be used.

HARVESTING.

As the plant does not bear all its flowers at the same time, all the nuts, even on a single plant, do not mature simultaneously. The crop is, however, considered as about ready to be harvested when the lower leaves of the plant turn yellow and the peduncles become tough and dry. At lifting time the majority of the kernels should no longer be milky but loose in the pods with the papery covering or testa firmly attached. The best signs of ripeness are a good, bright, red colour of the kernel, which will change to a deep red when properly dried, and a change from white to blackish-brown on the inside of the pod. Great care should be taken not to lift the crop before or long after the majority of kernels are in this condition, otherwise both quality and quantity of the crop will suffer.

LIFTING.

This is usually accomplished by running a single-furrow plough along one side of the rows only. With some makes of ploughs it is necessary to remove the mouldboard, while with others it will be found necessary to plough both sides of the rows. In some localities two single-furrow ploughs are attached to a crossbar and drawn by a team of oxen, but this has not proved entirely satisfactory even under favourable conditions. Double-furrow ploughs and dismantled gang ploughs adapted for single-furrow work have at times been used successfully. Potato diggers have proved satisfactory only when drawn by horses or mules, and then only when the plants are spaced widely apart in the rows.

STACKING.

When grown on a large scale the plants, after lifting, are allowed to dry in windrows made by packing the plants from two or three rows in one closely packed row with the nuts upwards. The method of drying the plants in small bunches scattered over the field cannot be

recommended, as too rapid drying causes a brittle hay and may affect the quality of the nuts. After one to three days the plants, when sufficiently dry, are packed with the nuts inwards in large conical-shaped stacks or small heaps, built so as to shed water in case of rain. The packing of small quantities around poles is a practice followed where small quantities of nuts are grown. If deemed necessary a small covering of grass may be placed on the peaks of the stacks.

PICKING.

In good weather, when the hay is in a fit state to be stacked, the nuts are usually dry enough to be stripped off the vines, which is done either by hand or by means of stripping machines. Hand picking is done chiefly by natives: this method is slow, one person picking generally from 70 to 90 lb. weight of nuts per diem at a cost ranging from 1s. to 1s. 6d. Producers of large quantities of

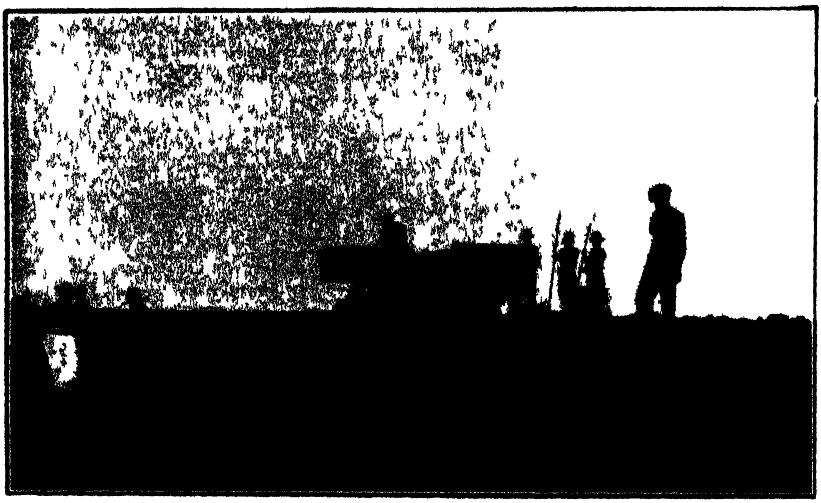


FIG. 4.—Peanut picking by machinery.

nuts will find machine pickers far more economical and faster than hand picking. The picking machines that have proved satisfactory in this country are the Heebner and Benthal peanut pickers, manufactured in the United States. Several threshing machines, as well as locally invented and imported pickers, have been tried, but none has proved as satisfactory as the two special pickers mentioned above. Peanut picking machines must be able to remove the marketable nuts with a minimum amount of breakage, to remove the stems and "tails" or portions of the peduncle, and to grade and winnow the nuts. New machines require an unusual amount of settings and numerous alterations before they will work properly. It is therefore very necessary that operators should make patient trials and bring some ingenuity into play before condemning a particular machine.

As it is advisable to handle the whole plants as little as possible, the nuts should be picked direct from the windrows or from the stacks. At picking time the nuts should be absolutely dry and the haulms slightly green.

YIELDS.

The average approximate yield in the Union is ten bags of 70 lb. each per acre. Yields of fifteen bags should be obtained in good farming, while yields of 20 to 25 bags per acre are fairly common where the soil is properly worked and the fertility maintained. Yields of 30 bags to the acre are not uncommon, while a yield of 100 bags per acre has been known. South African yields compare very favourably with those obtained in America, where the average varies from 14 to 20 bags per acre, while yields of 25 to 28 bags are considered very good.

FIG. 5.—A home-made sheller.

MARKETING.

Before bagging, the nuts, if not thoroughly dry, should be dried preferably in an airy shed. In the picking operation the nuts are often well enough graded for ordinary commercial purposes, but to obtain the best results they should be screened and graded in order to remove stones, earth, and broken nuts. Circular sieves made of square-holed wire mesh fitted on a properly constructed rotary frame are recommended for grading purposes.

Ordinary grain or muid sacks of peanuts weigh from 75 to 90 lb. according to the size and quality of the nuts. The introduction of a special bag to hold 100 lb. of nuts has not found favour with the growers. As the weight of a bag of nuts varies considerably, trade

in this product is conducted upon the basis of the hundredweight. The bushel weight also varies from 20 to 30 lb.

Special grades for peanuts have not as yet been established. Market quotations are generally for "Virginias" or "Kaffirs," the former a three-kernelled, thick-shelled type and the latter a three-kernelled, thin-shelled type. As the industry expands it will probably be to the advantage of both buyers and growers to introduce definite grades.

The prices obtaining naturally fluctuate from season to season. Immediately after the war the Johannesburg market price ranged from 20s to 30s. per hundredweight, but of late it has dropped considerably owing to increased production with no corresponding increase in the demand. Prices ranging from 6s. to 30s. per cwt. have been realized, although from 11s to 18s. is the range usually quoted. The average prices for the year 1918 to 1923, according to the Union Year Book No. 7, are as follows:—1918, 15s. 2d.; 1919, 20s.; 1920, 24s. 6d.; 1921, 11s.; 1922, 11s. 5d.; 1923, 13s.

THE COST OF PRODUCTION.

As local conditions determine to a large extent the cost of producing a crop of peanuts, accurate figures applicable to all the peanut areas of the Union cannot be given here. Furthermore, no detailed survey has been made of the peanut growing industry, and, therefore, no accurate figures as to costs of production are available. The following is an estimate only, but is considered a fairly reliable guide:—

COST OF PRODUCING ONE ACRE OF PEANUTS.

	£	s.	d.
Ploughing	0	4	6
Planting	0	2	0
2 Harrowings	0	2	0
Cultivation and ridging	0	2	6
Seed	0	5	0
Ploughing out and stacking	0	6	6
Picking	0	15	0
Carting	0	2	6
Cleaning	0	3	0
Bags	0	15	0
Rent, including depreciation on implements, upkeep of buildings, and cost of fencing, etc.	0	5	0
	£3	3	0

At the average yield of 700 lb. per acre the cost of production would be 9s. per 100 lb., while if 1,000 lb. is obtained per acre the cost would be 6s. 4d. per 100 lb.

SHELLING.

On the farm little shelling is done beyond the small amount required for seed. Occasionally when the pods have been discoloured by heavy rains at harvesting time or by a sticky soil, the peanut is marketed in the shelled state. Shelled nuts, however, do not keep

very well and are easily injured in handling. Broken kernels are the first to deteriorate, and should be screened out immediately after shelling. Shelling may be done either with home-made or power shellers. There are several types of the latter on the market, some being suitable for household or farm purposes and others for factory use only. Both imported and locally invented peanut shellers are obtainable from agricultural machinery agents.

Although shelling may be done with extreme care, a certain percentage of kernels is often broken. The shelling ratio or proportion of kernels to shells is two of kernels to one of shells by weight. Shelled nuts should also be graded before being marketed.

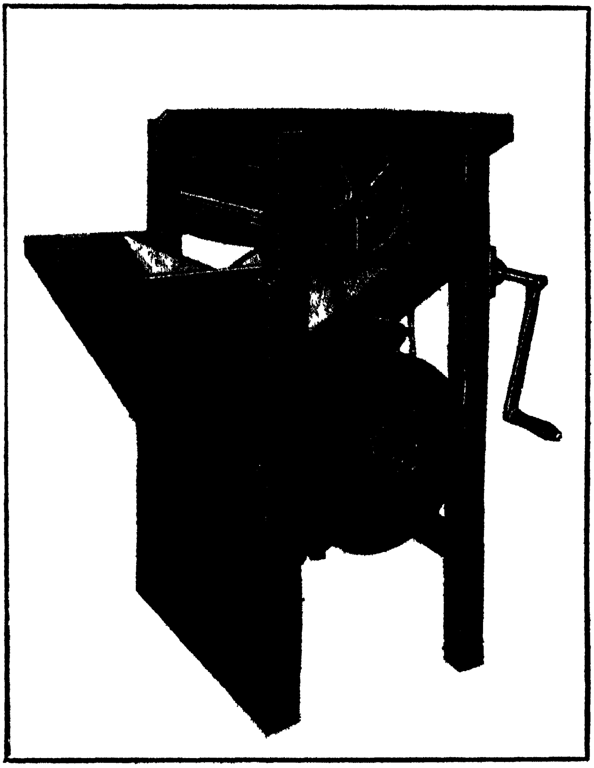


FIG. 6.—A Benthal peanut picker.

DISEASES.

Melasma.—Various species of this plant are parasitic on peanuts and leguminous plants in much the same manner as " Rooibloem " or witchweed is parasitic on maize and other members of the grass family. The *Melasma* plants are annual herbs with yellow or orange flowers, and are closely related to the witchweed. The presence of the parasite is usually first indicated by a yellowing and wilting of the peanut plants in patches in the field, and if the parasite is allowed to grow unchecked it may lead to serious losses. The only practical method is to hoe it out by hand, and repeatedly, as small plants

easily escape detection. *Melasma* plants seed very freely, and if not destroyed before seeding, the ground becomes heavily infested and control in subsequent years more difficult. Agricultural implements, etc., should be well cleaned after use on an infested land, because the *Melasma* seeds are very small and may easily be carried from one plot to another.

Rosette.—This disease has done great damage to the crop in the northern Transvaal. The severity of the trouble varies somewhat with the season and with the time of planting. *Rosette* is being studied at present, and the latest information seems to show that it is an infectious disease of the filterable virus type. It can be transmitted from one plant to another by certain plant lice, and possibly by other insects as well.

Foot Rot or Root Rot.—This disease is characterized by a premature yellowing, wilting, and finally dying of the affected plants. On pulling up a diseased plant, it is found that the roots are badly rotted and covered in places by a whitish fungal growth. The rot usually extends into the pods and the developing nuts, and may cause great damage. The disease is greatly favoured by moist conditions of the soil, while good cultivation and aeration tend to retard it. The only practicable means of control is crop rotation, and this should be instituted before the soil is badly infested.

Leaf Spots and Mildews.—During wet seasons various mildews and leaf-spot diseases are of common occurrence wherever peanuts are grown. These diseases may be controlled by spraying, but it is questionable whether this would be a profitable practice.

ANIMAL ENEMIES.

Up to the present peanuts appear to be very free from insect attack, the only complaints being in regard to termites or "white ants" as they are frequently called. Damage is also caused by guinea-fowls and veld rodents such as field rats and spring hares.

Termites (Isoptera).—These are too well known to need any description. They are sometimes exceedingly troublesome to agriculturists. The only effective method of combating them is to exterminate the entire colony or colonies causing trouble. This is best done by pumping arsenic and sulphur fumes into the workings with a pump fitted with a firebox and a pumping apparatus. Such an apparatus as the universal ant exterminator is the most convenient. The formula used is: White arsenic (finely powdered), 3 parts by weight; sulphur (flowers), 1 part by weight. Mix the ingredients thoroughly, volatilize, and pump into the termite workings.

Very promising results have recently been obtained by blowing finely powdered calcium cyanide into termite workings by means of a blower. This method will probably be developed, as it is much more convenient than the arsenic and sulphur treatment, and appears to be very effective.

Rodents.—The chief rodents complained of are spring hares (*Pedetes caffer*) and field rats. In some areas spring hares are so bad that a considerable portion of the crop is harvested by them.

Spring hares can be controlled to some extent by trapping and by shooting, but these means are not sufficiently effective to give much

relief, and do not help in controlling the other field rodents at all. The following methods of poisoning rodents with barium carbonate has been proved to be most effective by the Department of Public Health. Barium carbonate is a white, tasteless powder procurable at most druggists at about 2s. per pound. It is mixed with finely ground peanuts, when a poisonous bait attractive to field rodents results. Good, sound peanuts are ground into a fine powder by passing them at least twice through a good mincing machine. The paste so obtained is thoroughly mixed with barium carbonate in the following proportion, and the mixture can then again be passed through the mincing machine, viz.:—Barium carbonate, 1 part by volume; raw peanut paste, 3 parts by volume. The mixture is made up into pellets about the size of a large pea or small marble. If the material is not sufficiently moist to allow of these pellets being readily made, a very small amount of water may be added after mixing.

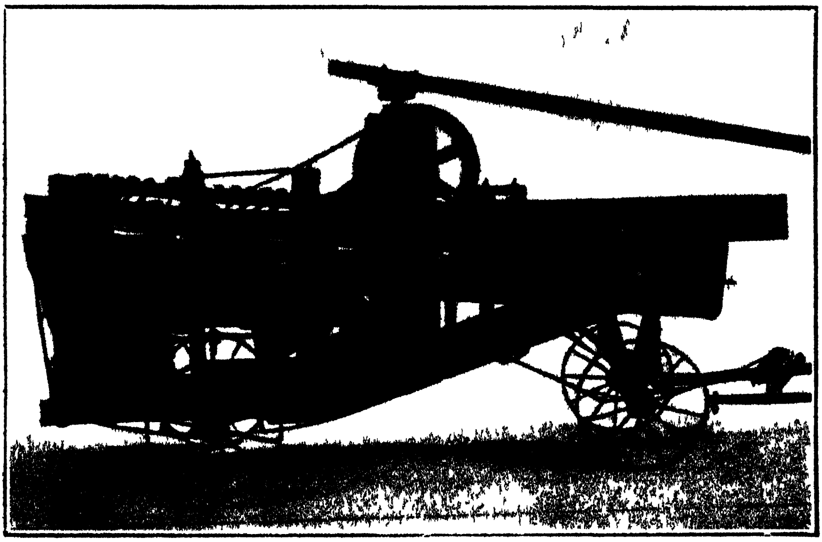


FIG. 7.—Peanut sheller with blower attachment. This type costs from £40 to £50.

In feeding these pellets a definite number is placed in or near the entrances to the burrows of the rodents. As the spring hares are nocturnal in habit, it is best to place the bait in position towards evening. The bait is left in position, and is examined next day to ascertain whether any pellets have been taken. It might be advisable to bait a second time and to repeat this again and again if the pellets are taken readily. The rodents will not die immediately after taking the bait, so patience must be exercised. If the pellets are not taken it may be advisable to try mealie meal in place of the peanut paste, using the same proportions as stated above and moistening the mealie meal very slightly.

Guinea-fowl (Numida).—While these birds are most useful in South Africa, they do considerable damage at times in eating up peanuts and other seed soon after it has been planted.

JUDGING.

In judging entries of peanuts at agricultural shows, a number of pods are shelled in order that consideration may be given to the following points, viz.:—Maturity of kernels and pods; uniformity of kernels; brightness and vitality of kernels; trueness to type.

The pods should be brownish in colour on the inside, while special consideration is given to soundness and nutty flavour of the kernels.

USES.

Commercial.—Peanut oil is one of the world's important oil products. The kernels contain 45 per cent. or more of oil known commercially as arachis oil. This oil is often sold as a substitute for olive oil. The best edible oil is extracted by cold pressure, while that expressed hot is used for lubrication and soapmaking. The expression can be done at the factories dealing with cotton seed for oil expression. Very little of the peanut crop grown in the Union is at present utilized for oil expression or soap manufacture, the soap factories usually importing supplies from the East Coast. If South African nuts are used the type preferred is the two-kernelled Natal nut.

For Live Stock.—The parts of the plant and all the by-products resulting from factory processes can be used to advantage in the live stock industry. The nuts are not usually fed to cattle, although pigs may be allowed to harvest the crop or may be allowed in the fields after harvesting. Feeding pigs on too many peanuts will cause soft pork.

Hay.—The hay, if harvested before the first frosts, is of good quality, while plants with few nuts adhering have a feeding value approximating that of lucerne. From a quarter to half a ton of hay may be obtained per acre after the nuts have been removed. If allowed to dry too much there is great loss of leaf, and the resultant hay is coarse, fibrous, and of lower feeding value. The hay must also be handled carefully, as it is very brittle, while if containing sand or dust it should be fed in wire-bottomed mangers. Sheep must be fed with care, as they are liable to bloat if given too much hay.

Oil-cake.—After the oil has been expressed from the nuts, the resultant cake, which contains a fair percentage of oil, forms a rich and palatable concentrated feed for live stock. It is not injurious to stock nor does it impart a flavour to the milk.

Human Consumption.—By far the greater part of our production is used for human consumption. There is no vegetable food so rich in protein and fat as peanuts and yet requiring so little preparation to make it edible and palatable. Roasted peanuts, of which thousands of tons are consumed annually, are a well-known and popular form, which is used to some extent in the preparation of breakfast foods, while large quantities are required by the confectionery trade. Peanut butter is also becoming more popular, while the oil may be used in cooking. A meal made from peanuts may also be used for mixing with flour for breadmaking and for other household purposes.

Peanut Butter.—This product, which is cheap and wholesome and can be made at home with little trouble, has a high food value,

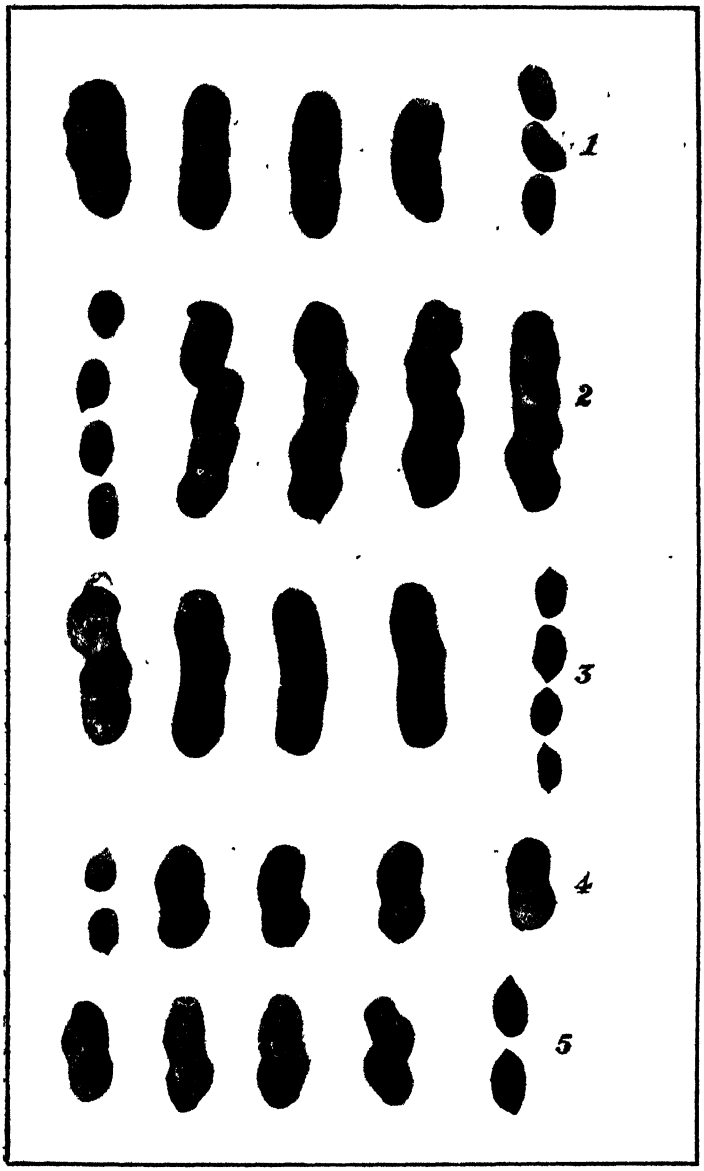


FIG. 8.—Types of pods and kernels.

1. Tennessee.
2. Spanish.
3. Virginia Bunch.
4. Natal Common.
5. Kaffir.

and is far better and more palatable than poor butter. For those who wish to make this nutritious food at home, the following particulars are given:—Shelled nuts are roasted in a roaster or oven until well cooked. If roasted in a pan, they must be stirred continuously to prevent burning and ensure uniform cooking. When cooked, they are cooled, the red skins are rubbed off and blown out, and the germs sifted out from the nuts. The nuts are then finely ground in an ordinary meat mincing machine, salt being added according to taste. The butter should be kept in glass-stopped bottles or air-tight tins. It will be found that the oil in the butter will cause rubber rings, if used, to perish very quickly. Peanut butter can be used for sandwiches, as a meat substitute, and for cooking purposes in place of lard.

VARIETIES.

Several varieties are cultivated in the Union. Some have thin, hard pods, while others have thick, soft ones. The kernels are of varying sizes and colours. Improved varieties have usually three or four medium-sized kernels in each nut, and are upright growing, with the pods more or less closely bunched.

Virginia Bunch.—This variety is grown almost exclusively in the Union. It has comparatively thick-shelled pods, containing usually four bright reddish kernels. As the name indicates, the pods are borne in a bunch close to the plant.

Kaffir.—This variety, at one time the principal variety, is to-day being grown in very small quantities in one or two localities only. Where it is grown it is impure, being mixed with introduced strains. On the markets it generally realizes low prices, although occasionally a specific demand exists for this variety. It has a decumbent habit of growth which makes harvesting difficult. The pods are thin-shelled and coarse, containing generally one or two light-coloured, sweet kernels, which are low in oil-content. The yield obtained from this variety is very unsatisfactory, and it is doubtful whether it will ever again come into prominence.

Natal Common.—This variety somewhat resembles the "Kaffir," the chief differences being that the kernel is not sweet, while the pods are more regularly two and three kernelled. Furthermore, the nuts are bunched as in the Virginia Bunch and not spread over a large area. It is early and a good yielder. In many respects it is similar to the Spanish variety grown in the United States.

Jumbo.—This is a recently introduced, somewhat decumbent type. It bears large, tough-shelled, two-kernelled nuts and is late-maturing. It is doubtful whether it will supersede the Virginia Bunch, as up to the present it has not given outstanding yields.

There are several other varieties, such as White Chinese, Valencia, Spanish, etc., which are not as yet of any importance.

EXPORT.

There is a great demand for peanuts overseas. France and Great Britain are the largest importing countries, while the Netherlands, Belgium, and Italy also import fairly large quantities annually. We cannot, however, export peanuts profitably until the cost of production is reduced by the greater use of machinery and

the production of larger yields per acre. This is particularly so under present freight and railage rates. In the world's markets South African peanuts have to compete with an article produced for oil expression by very cheap labour in India, Asia, and on the east and west coasts of Africa. There is, however, a demand in England and on the Continent for high grade nuts for edible and confectionery purposes, and these the Union can produce. London buyers have expressed great satisfaction with South African high grade nuts, but the trade will never assume any importance until a regular supply of fairly large quantities is forthcoming. It is suggested in this respect that at least 100 tons a month should be offered. Apparently much has still to be done to open up this venue of trade.

ORGANIZATION AND FUTURE OF THE INDUSTRY.

A nut growers' association has been formed at Naboomspruit, a class of organization which is very desirable in the more important peanut producing areas. Through the combined efforts of associations much can be done to solve the problems of the industry, particularly the securing of high-grade seed, better methods of harvesting, establishment of standard grades, and the opening up of markets.

As the demand for peanuts for all purposes is increasing very rapidly the future of the industry seems assured. It only remains for growers to organize and improve their knowledge of the crop and methods of culture in order to take advantage of the opportunities offered by the industry.

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DO PIGS FED ON MAIZE-MEAL AND GREEN LUCERNE REQUIRE BONE-MEAL?

By THOS. D. HALL, Chemist, and S. P. DE WAL, Stockman, School of Agriculture and Experiment Station, Potchefstroom.

THE practical pig-raiser generally considers that maize and green lucerne are a sufficiently well-balanced and complete ration. In the experiment here recorded an endeavour was made to ascertain whether the addition of one or two ounces of bone-meal per pig per day to such a ration would not improve their general health, their appetites, their weight, and the quality of the killed product.

The experiment was started with nineteen Large Black and Berkshire gelts and boars, approximately three months old. They were confined in paved and walled sties during the whole period of the experiment. Details of the animals will be found in Table I of the Appendix. As several prominent pig farmers have already interested themselves in this experiment, and have wanted the exact weights of feeds and of the pigs at various ages, all the data are being given in the Appendix. It is difficult for farmers to get the weekly gains of young pigs under South African conditions, and it is thought that these figures will be appreciated on that account.

The experiment was started on 10th October, 1924, when each pig received per day 2 lb. of maize-meal, 1 lb. of skimmed milk, 1 lb. of green lucerne, and the bone-meal lot ½ oz. per pig of that substance. By the end of the experiment on 13th January, 1925, the maize-meal had been increased up to 5½ lb. per pig, the lucerne to 1½ lb., and the bone-meal lot had been getting up to 2½ oz. of that substance. The skimmed milk was stopped quite early in the experiment. Details of the feeding periods and the exact amounts fed in those times will be found in Table II of the Appendix.

At the start the bone-meal lot contained ten pigs, totalling 550 lb. and averaging 55 lb., the non-bone-meal lot (nine pigs), totalling 557 lb. and averaging 61.8 lb. per pig. In the bone-meal lot was one runt and one with a wry neck, so that constitutionally this group started at a disadvantage. Every endeavour was made to balance the sexes and breeds and eliminate error in weights which might be caused by such factors. The weekly differences in weight of each pig over the whole period of the experiment will be found in Tables IV and V of the Appendix.

GENERAL OBSERVATIONS ON THE EXPERIMENT.

1. No apparent difference in appearance could be observed between the bone-meal and the non-bone-meal pigs during the course of the experiment. The non-bone-meal pigs started at a higher average weight and maintained it right through the ninety-six days of the experiment. An original better average constitution for the non-bone-meal lot might explain the higher average weight over the period in question.

2. The average increase per pig, however, in spite of this constitutional drawback, was higher in the bone-meal lot with the exception of the seventh and the ninth periods (Table II). It will be seen that these are the periods the bone-meal was reduced from 2½ oz. to 1½ and 1 oz. The average gain per pig was 5 lb. more for the bone-meal lot, or an increase of 50 lb. over the non-bone-meal lot. The cost of 77 lb. of bone-meal was 6s. 10d., and the value of the increase, less 7 per cent. loss in weight at 8d. per lb., is 31s., showing a profit of 24s. 2d. for the bone-meal, when other costs are not taken into consideration. The actual final profit was 15s. from the use of bone-meal.

3. The average daily gain for the bone-meal pigs was 1.2 lb. as against 1.16 lb. for the others, and 4.71 lb. of food was eaten by the former for every 1 lb. gained in weight, as compared to 4.85 lb. by the latter. In a previous experiment conducted here pigs fed on skimmed milk and maize consumed 4.5 lb. of the mixture for every pound gained.*

4. The cost per pound of gain was also lower in the bone-meal lot, i.e. 3d., as compared with 3.14d.

5. From the Johannesburg abattoir weights, it would seem that a loss in live-weight of 7 per cent. can be expected, even in so short a journey as 88 miles, which is the distance by rail from Potchefstroom. Five of the gelts were kept back for further experiments, and the other fourteen pigs were shipped off to the market on 13th January, 1925. The abattoir weights showed a loss of 8 to 17 lb. per pig, or a 5 to 9 percentage loss. The average loss per pig was 12.7 lb., and the average percentage loss was 7 lb. The abattoir live-weights (Tables VI and VII) are thus calculated on the basis of a 7 per cent. loss in shipping. On the abattoir live-weights 8d. per lb. was obtained.

6. From the appended report of our veterinary surgeon, who saw the pigs weighed and killed, it will be seen that no apparent difference was discernible between the two lots.

CONCLUSION.

It would appear that the ration of maize-meal and green lucerne as fed supplied almost sufficient phosphoric oxide and lime for the requirements of the pigs. A better gain, a more economical use of food, a smaller cost per pound of gain, and the 24s. 2d. profit from the bone-meal make its use advisable even with this ration.

After deducting from the total apparent profit, the value of the pigs as suckers estimated at 4d. per lb., the net average profit per pig was £2. 17s 3d. for those on bone-meal and £2. 15s. 9d. for those without it.

There was thus 1s. 6d. more profit per pig on the bone-meal lot, or 15s. in all.

It is significant that during the two periods when the bone-meal was reduced in amount to 1½ and 1 oz., the amount of gain fell below that of the non-bone-meal pigs. It should also be remembered that about 80 per cent. of the bone-meal is recovered in the manure, and so it is able to bring in further profits as a fertilizer and at the same time supplies the farmer with a better balanced manure.

* See article "White *versus* Yellow Maize as a Pig and Poultry Food" in *Journal of the Department of Agriculture*, October, 1923.

APPENDIX.

REMARKS ON THE SLAUGHTERED PIGS.

By the Veterinary Surgeon, Mr. A. S. CANHAM, M.R.C.V.S.

The animals were allowed to stand for an hour before being slaughtered in the usual abattoir method. The carcasses were taken to a cold storage after an inspector had declared no disease to be present. When the pigs were hung up prior to setting, little if any difference could be seen between the two lots. The skin had in some few cases red stripes caused by a whip, thus showing how easily pigs are marked. These marks detract from the appearance. The flesh in general was of good colour, small amounts of fat being evenly distributed through the meat fibres. The fat was of good colour, and the appearance before setting did not give one the impression that it would be anything but firm. The meat had a good odour.

The Berkshires were very fat, in fact, slightly too fat, while the Large Blacks were favourably commented on. The butchers remarked on the fineness of the bone, the not-too-fat shoulders, and the very fair loins of the Large Blacks. This was on the score of bacon. As for hams, the Berkshires were very good. The report after setting, and the dead-weights, are still being awaited from the cold storage.

Several points were made by an experienced cold storage man:—

(1) After the pigs arrive at the market and are weighed, they should be allowed to rest for twenty-four hours before killing, as they then appear to set better.

(2) For bacon pigs, the shoulder should not be so well developed as in Berkshires, because this joint is of the least value.

(3) Crossing the Tamworth with the Berkshire will give smaller shoulders. Another point in favour of this cross is the smaller head produced, still another saving for the butcher. Fine boned and framed pigs should be used for baconers. The Large Blacks are not fine enough and the Berkshires are too fine-boned.

(4) The Estcourt Bacon Factory favours the Middle-white and Large Black cross. Specimens of the cross were in the cold storage; while they have the length of back of the Middle-White, their shoulders are toned down and their loins are well developed. This cross appears to make an excellent bacon pig.

(5) The weights most desired are 180 lb. to 190 lb., and the animals should be about seven months old.

(The pigs in this experiment averaged 172 lb. at six months: in another week they would have averaged just over 180 lb.)

TABLE I.

Sex, Age, Weight, and Breed of Pigs Used.

Lot No. I, on Bone-meal.					Lot No. II, without Bone-mel.				
No.	Sex.	Weight.	Breed.	Date of Farrowing.	No.	Sex.	Weight.	Breed.	Date of Farrowing.
		lb.					lb.		
47	B	67	Berk.	5/7/24	46	B	69	Berk.	5/7/24
48	B	63	"	"	51	B	49	"	"
49	B	59	"	"	67	S	56	"	"
55	B	60	"	"	70	S	54	"	"
71	S	48	"	"	85	S	51	Large B.	19/7/24
83	S	60	Large B.	6/7/24	92	B	65	"	6/7/24
84	S	36	"	19/7/24	93	B	78	"	"
96	B	55	"	"	94	B	66	"	"
97	B	48	"	"	95	B	69	"	"
98	B	54	"	"	—	—	—	—	—

	Lot No. I.	*Lot No. II.*
Total weight	550	557
Average weight	55	61·8

Note.—No. 49 had a wry neck; No. 84 was very small at farrowing.

TABLE II.

Amounts Fed per Pig per Day, and Amounts of Phosphoric and Calcium Oxides in Ounces in the Feeds.

No.	Period Ending.	Maize-meal.	Green Lucerne.	Skimmed Milk.	Bone-meal, Lot I only.	In Total Ration. Phosphoric Oxide.	In Total Ration. Calcium Oxide.	In the Bone-meal. Phosphoric Oxide.	In the Bone-meal. Calcium Oxide.
						Oz.	Oz.	Oz.	Oz.
1	24th Oct., 1924	2 lb.	1 lb.	1 lb.	½ oz.	0·231	0·178	0·11	0·15
2	31st Oct., "	3 "	1 "	1 "	½ "	0·327	0·183	0·11	0·15
3	6th Nov., "	3 "	1½ "	—	1 "	0·306	0·230	0·22	0·30
4	13th Nov., "	3 "	1½ "	—	2 "	0·306	0·230	0·44	0·60
5	20th Nov., "	3½ "	1½ "		2 "	0·354	0·233	0·44	0·60
6	27th Nov., "	4 "	1½ "		2½ "	0·402	0·235	0·55	0·75
7	4th Dec., "	4½ "	1½ "	—	1½ "	0·450	0·238	0·33	0·45
8	11th Dec., "	4½ "	1½ "	—	2½ "	0·450	0·238	0·55	0·75
9	13th Jan., 1925	5½ "	1½ "	—	1 "	0·546	0·242	0·22	0·30

The bone-meal was varied in amount to see if there would be any apparent effect on the digestion of the pigs, but none was noticed. There was, however, a distinct loss in gain in periods 7 and 9, when it was reduced in amount.

The figures given in ounces under "In Total Ration" are not inclusive of the bone-meal.

TABLE III.

Phosphoric and Calcium Oxides in the Feeds.

Feed.	Phosphoric Oxide. Per Cent.	Calcium Oxide. Per Cent.	Ounces per 100 lb. Phosphoric Oxide.	Ounces per 100 lb. Calcium Oxide.
Maize-meal	0·60	0·03	9·6	0·48
Green Lucerne	0·08	0·90	1·2	14·40
Skimmed Milk	0·17	0·15	2·7	2·40
Bone-meal	22·00	30·00	352·0	480·00

TABLE IV.

Record of Weight Increase of Bone-meal Pigs in lb. (10th October, 1924, to 13th January, 1925.)

No.	10th Oct.	16th Oct.	23rd Oct.	30th Oct.	6th Nov.	13th Nov.	20th Nov.	27th Nov.	5th Dec.	11th Dec.	7th Jan.	13th Jan.
47	67	78	89	93	100	108	118	128	140½	148	190	199
48	63	72	81	87	93	102	113	122	133	140	179	187
49	59	66	74	79	85	87½	89	97	107	113	150	154
65	60	70	78	84	84	100	111	119	129½	133	173	176
71	48	55	63	68	75	80	90	97	108	111	142	148
83	60	70	77	82	87	93	103	111	122	132	139	162
84	36	43	48	52	56	60	65	71	78½	126	180	191
96	55	66	74	81	87	94	104	114	129	136	177	190
97	48	56	66	75	81	86	96	107	117½	126	180	191
98	54	65	73	82	87	90½	102	112	125	133	177	187
Total	550	641	723	783	836	911	991	1,078	1,190	1,257	1,644	1,716
Average...	55	64·1	72·3	78·3	83·6	91·1	99·1	107·8	119	125·7	164·4	171·6
Total increase	—	91	82	60	53	75	80	87	112	67	387	72
Average increase ...	—	9·1	8·2	6·0	5·3	7·5	8·0	8·7	11·2	6·7	38·7	7·2

TABLE V.

Record of Weight Increase of Pigs Without Bone-meal. (10th October, 1924, to 13th January, 1925.)

No.	10th Oct.	16th Oct.	23rd Oct.	30th Oct.	6th Nov.	13th Nov.	20th Nov.	27th Nov.	5th Dec.	11th Dec.	7th Jan.	13th Jan.
46	69	80	88	94	98	106	105*	111	124	130	167	178
51	49	59	63	75	79	82½	88	98	108	116	152	160
67	56	65	73	79	82	87½	97	105	115	122	153	160
70	54	61	67	74	79	85	92	100	109	115	148	156
85	51	60	67	71	76	79	87	95	104	111	144	149
92	65	72	81	85	88	94	101	112	121	130	171	177
93	78	90	96	102	109	114	127	138	150	162	205	219
94	66	73	84	87	93	99	105	114	125	131	175	186
95	69	75	86	93	96	101	110	116	127	130	171	177
Total weights	557	635	705	760	800	848	912	989	1,083	1,147	1,486	1,562
Average weights ...	61·8	70·5	78·3	84·4	88·8	94·2	101·3	109·8	120·3	127·4	165·1	173·5
Total increase	—	78	70	55	40	48	64	77	94	64	339	76
Average increase ...	—	8·6	7·7	6·1	4·4	5·3	7·1	8·5	10·4	7·1	37·6	8·4

* No. 46 Leg fractured on 18th November, 1924.

TABLE VI.

Summary of Main Points.

	With Bone-meal (10 Pigs).	No Bone-meal (9 Pigs).
	lb.	lb.
Total end weight	1,716	1,562
Total initial weight	550	557
Total gain in weight	1,166	1,005
Average gain in weight (per pig)	116·1	111·6
Average total daily gain	12·1	10·48
Average total daily gain (per pig)	1·2	1·16
Food eaten per lb. gain	4·71	4·85
Cost per lb. increase for food only	3d.	3·14d.
Total abattoir live-weight	1,596 lb.	1,452 lb.
Cost per lb. increase on abattoir live-weight ...	3·4d.	3·6d.

TABLE VII.

The Costs, Values, and Profits.

	Bone-meal Lot (10 Pigs).	Non-Bone-meal Lot (9 Pigs).
1,596 lb. live-weight at 8d.	£53 4 0	1,452 lb. at £48 8 0
Less cost of feed	14 19 8	13 3 5
„ cost of boy ($^1/_{24}$ of his time for 96 days)	0 7 10	0 7 10
„ cost of railage	0 10 1	0 9 0
Total apparent profit	£37 16 5	£34 7 7
Average apparent profit per pig	3 15 7	3 16 4

In order to get closer to the actual profits there must be subtracted from the apparent profit the initial value of the pigs as suckers at 4d. per lb. :—

	Bone-meal Lot (10 Pigs).	Non-Bone-meal Lot (9 Pigs).
Total apparent profit	£37 16 5	£34 7 7
Less value of 550 lb. at 4d.	9 3 4	557 lb. at 4d. 9 5 8
Net total profits	£28 13 1	£25 1 11
Net average profits per pig	2 17 3	2 15 9

There was thus 1s. 6d. per pig more profit for the bone-meal lot

Amounts and Value of Total Food Fed in Ninety-six days.

Lot No. I on Bone-meal :—

3,870 lb. of maize-meal, at 7s. per 100 lb.	£13	10	10
1,330 lb. green lucerne, at 1s. 3d. per 100 lb.	0	16	6
220 gals. skimmed milk, at 3d. per gallon	0	5	6
77 lb. 3 ounces bone-meal, at 9s. per 100 lb.... ...	0	6	10
	£14	19	8

Lot No. II :—

3,483 lb. maize-meal, at 7s. per 100 lb.	£12	3	9
1,197 lb. green lucerne, at 1s. 3d. per 100 lb.	0	14	10
198 gals. skimmed milk, at 3d. per gallon	0	4	10
	£13	3	5

DEPARTMENTAL NOTICES.

BULLETINS OF INTEREST TO FARMERS.

The Department of Agriculture issues, on application, bulletins dealing with various agricultural matters. Many of these are reprints of articles that have already appeared in the *Journal*. In addition, there are science and other bulletins published separately and not through the *Journal*.

Some of these publications are obtainable free of charge, but the majority are priced at 3d. and 6d. each, and must be prepaid.

Any one wishing to utilize this means of acquiring agricultural literature should obtain a list of the bulletins. This will be sent post free on application to the Department of Agriculture, Union Buildings, Pretoria.

The following are some of the more important bulletins available:—

3d.	Cotton Culture	Repr.	2/1924.
	Onion Growing	,,	15/1924.
6d.	Phosphorus in the Live Stock Industry	,,	18/1924.
3d.	Diseases in Sugar-cane of the Mosaic Type in South Africa	,,	32/1924.
	Wild-fire in Tobacco in South Africa	,,	37/1924.
	Jointed Cactus	,,	38/1924.
	The Spinose Ear-tick	..	7/1925.
3d.	American Stocks in Viticulture	,,	17/1925.
3d.	Incubation in South Africa	,,	32/1925.
3d.	Codling-moth in Apricots	,,	33/1925.
3d.	Drought-resistant Fodders	,,	36/1925.
3d.	The Origin, History, and Characteristics of our Breeds of Pigs in South Africa	,,	39/1925.
3d.	Vermin-proof and other Fencing	,,	42/1925.
3d.	The Agricultural Problem in South Africa	,,	44/1925.
	Intensive Poultry-keeping for Town Dwellers	,,	45/1925.
3d.	Irrigation, with Special Reference to the Economic Use of Water	,,	47/1925.
3d.	The Culture, Picking, Packing, and Shipment of Table Grapes	,,	1/1926.
	Scaly Bark in Citrus Trees	,,	2/1926.
	Agricultural Economic Conditions in South Africa	,,	3/1926.
	The Maize Jassid	,,	4/1926.
	Manuring of Transvaal Soils	,,	5/1926.
3d.	Dried Fruits	,,	6/1926.
	Sheep Blow-fly Control	,,	7/1926.
	Wart Disease of Potatoes	,,	8/1926.
	Raisin-making	,,	9/1926.
3d.	How to Conduct a Post-mortem	,,	11/1926.
	Anthrax	,,	7/1924.
3d.	Africander Cattle	,,	26/1924.
3d.	Sheep-shearing	,,	29/1924.
1s. 6d.	The Apple	Bul.	1/1925.
3d.	Tobacco Cultivation for Nicotine	,,	2/1925.
2s. 0d.	Comparative Study of the Citrus Industry in South Africa	,,	6/1925.
3d.	Kemp Fibres in the Merino Sheep		Sc. B. 34.
	Comparative Results of Analyses of Spirits and Brandies		Sc. B. 37.
3d.	Report on the Cost of Production of Maize Investigations, 1922-23		Sc. B. 38.
3d.	Streak Disease of Sugar-cane		Sc. B. 39.
3d.	Chemical Investigations in regard to Citrus		Sc. B. 40.
3d.	Note on Storage of Eggs		Sc. B. 41.
3d.	(1) Further Investigations into the Causes Producing Rosette of Apricot and Plum Trees in Wellington District; (2) Report on some Preliminary Investigations into the Influence of Alkali Soils on Peach Stocks employed for Apricot and Plum Trees		Sc. B. 42.
3d.	Some Factors Influencing the Keeping Qualities of Butter		Sc. B. 43.
3d.	A Biometrical Analysis of Wools		Sc. B. 44.

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AGRICULTURAL LITERATURE.

THE present is the second issue of the *Journal of the Department of Agriculture* in its quarterly form. It was first issued in April, 1920, and from then appeared monthly up to and including March, 1926.

The *Journal* records the work of the Department and the results of its investigations and experiments. In addition, the Department publishes monthly *Farming in South Africa*, which gives, in short articles and notes, plain, practical advice to farmers; the information it contains is based on the experimental work and experience generally of the Department. It has a wide circulation and serves as a link between the farmer and the Department.

There are other Departmental publications in the form of "Crops and Markets" published monthly, science and other bulletins, published as occasion arises, and weekly advice leaflets.

Further details in regard to the literature issued by the Department may be obtained on application to the Editor of Publications, Department of Agriculture, Pretoria.

THE GROWING OF SNUFF TOBACCO.

By LLOYD WORRALL, M.Sc.(Agr.), Senior Tobacco and Cotton Officer, Barberton

OWING to the increased interest in the Barberton and adjoining districts in the production of tobacco for snuff purposes, the following short article is published for the guidance of new growers, the main object being to outline the actual practice as carried out by the most successful growers of this class of tobacco in the De Kaap Valley, Barberton, where the bulk of it is grown.

As far back as 1895 tobacco was grown in this area by the late Mr. W. G. Exall, when the production was very small and chiefly used for pipe tobacco. It was not until 1906 that the planters turned their attention to the growing of a heavy, dark class of tobacco suitable for the native snuff trade. Buyers were prepared to pay a higher price for this snuff tobacco than formerly paid for average pipe tobaccos, thus stimulating production.

The snuff trade has gradually grown with the increased demand, and this tobacco is sold throughout the Transvaal, and parts of the Cape and Natal, for the native trade. A native is a discerning buyer and is prepared to pay a high price for a leaf that is suited to his requirements. The keen demand for the snuff tobacco grown in this area is not due to the cheapness of the article, but rather to the desirable qualities contained and so dear to the native's olfactory organ. For a number of years this leaf has been readily sold in bulk at 1s. 3d. per lb. when other dark tobacco could be bought at half that price.

Tobacco produced in this area has a rich, dark mahogany colour, good body, and a strong aroma, which is due to the soil, climatic conditions, and cultural methods. The percentage of nicotine is generally higher than found in any other class of tobacco produced in the Union other than *Nicotiana rustica*.

VARIETIES.

Two varieties are grown, namely, Exall's and Clarksville Heavy—practically 90 per cent. of the former and 10 per cent. of the latter.

The type known as Exall's is an upright one; leaves well spaced on the stalk, medium long, and inclined to be narrow, with a heavy midrib. This leaf cures out a rich mahogany colour with plenty of body, and has been selected and bred up by Mr. Exall, of Waterfall farm for the production of snuff tobacco.

The Clarksville Heavy has only recently been introduced and is giving excellent results. It is a large leaf variety, the leaves being pendant, of good length and width, but the body is not generally as thick as found in Exall's type.

Figure I shows some excellent plants of this variety. Some growers state that it does not cure out as dark a colour as Exall's variety. The writer is making some interesting comparisons with

these two varieties of tobacco for snuff production, the details of which will be published at a later date.

SOILS.

Dark tobaccos are grown with success on a greater number of soil types than any other tobacco, the best being produced on the heavier or more clayey soils rather than on the light sandy ones. Snuff tobacco is grown chiefly on the heavier red loams derived directly from the underlying diabasic dykes and on soils of granitic origin. Thos. D. Hall, in his bulletin on "Some Transvaal Soils," describes the soils as follows:—"The soil types in the De Kaap Valley are considerably modified, as the valley is surrounded by mountains of the Jamestown series, except on the west, where it is bounded by dolomite and quartzite mountains. Furthermore, there are numerous low-lying hills running through the valley in a north-westerly to south-easterly direction; these are diabase dykes, which also exert their influence in enriching the soil types. The principal soil types of the area are, however, of granitic origin."

FIG. 1.—Field of Snuff Tobacco ready for Cutting.

The mechanical analysis of a typical red sandy loam made by Mr. Hall is as follows:—

Moisture	4.06
Loss on ignition	6.86
Coarse gravel	1.00
Fine gravel	16.17
Coarse sand	32.10
Fine sand	9.21
Silt...	10.00
Fine silt	4.06
Clay	16.02

It will be noticed that even this soil is not a heavy one, the clay-content being only slightly over 10 per cent., while the main bulk is made up of coarse sand, which forms over 32 per cent.

Tobacco produced on this soil, with proper fertilizer and cultural treatment, yields a good type of snuff leaf. Soils play a very important rôle in determining the type of tobacco produced. It can generally be accepted that the lighter soils produce a thinner textured leaf, while the heavier ones turn out a coarse heavy leaf. The writer, when in America, studied the question of the influence of the physical nature of the soil on the character of tobacco produced, with the following conclusions:—

(1) That soils determine the class of tobacco grown more than any other factor.
(2) That both the surface and the sub-soil play a very important rôle in the production of a given type of tobacco.
(3) That meteorological conditions do in a measure determine the aroma of tobacco, but observations do not show definitely how this is accomplished.
(4) That different methods of curing influence the type of tobacco only after it has been produced, and this is not considered a direct influence in determining the type of tobacco.
(5) That the soil has a direct influence on the texture of tobacco grown; the higher the clay-content the coarser the leaf.
(6) That there is a definite correlation between the colour of the soil and the colour of the leaf produced, the darker coloured soils growing a darker coloured leaf. An exception to this rule is the turf soils.
(7) That each class of tobacco requires a special range of soils, and only by growing it on these special soil types can the best success be obtained.
(8) That fertilizers do not influence the *type* as a whole, but do exert a very direct influence on the *grade* within the type.
(9) That the chemical analyses of tobacco soils show no correlation with the type of tobacco grown, except in the case of the flue-cured tobacco and the White Burley.

It has been noticed even with snuff tobacco grown in this area that soils play an important part in the class of tobacco produced. Generally speaking, it is advisable to select a heavy type of soil for growing this leaf—one that contains a fair proportion of clay particles both in the top-soil and sub-soil. The soil must be well drained, as tobacco cannot be profitably produced on cold, undrained soils.

SEED-BEDS.

The seed-beds are usually planted from July to September. The practice is to plant a number of seed-beds in rotation during these months. As with other tobaccos, a well drained, light loam soil should be selected in a sheltered position for making the seed-beds. A general mistake with beginners is to make too few beds and to leave the plants too thick in the beds, resulting in undesirable weak plants for transplanting. The method of preparing and growing the seed-beds until the plants are ready for transplanting in the field is

described in bulletins supplied free of charge by the Sub-Division of Tobacco and Cotton, Transvaal University College, Pretoria. T care and treatment of the seed-beds is a very important step in the economic production of tobacco, and it is essential for every new grower to become acquainted with the best methods.

PREPARING THE SOIL AND PLANTING.

The soil must be well prepared before the young plants are placed out in the field as it is essential for them to have a continuous growth throughout their growing period. Practically the whole of the tobacco grown in this area is planted on irrigated soils, so the grower has control of moisture conditions for planting out and does not depend on suitable climatic conditions. Where no irrigation is possible the young plants are set out in the field during rainy weather. The soil should be well ploughed and harrowed before the actual small furrows are laid out for planting. The young plants are removed from the seed-bed when they are about six inches high, care being taken to soak the beds well with water to prevent undue injury to the tender rootlets. The plants are taken to the field in shallow boxes or tins, which are kept in the shade or covered until planting. The furrows are made from 3 feet 6 inches to even 4 feet apart, and the plants spaced every 3 feet in the rows. The distance of the rows apart and the spacing within the row vary considerably with different growers.

The practice is first to run the water down the rows, then plant out, and finally rewater to set the seedlings. Only the stocky plants are selected for planting out, as the weedy ones easily burn off during a hot sun. Shading is not a practice to recommend in this area, owing to the prevalence of insects which are attracted to the shade coverings.

FERTILIZING AND MANURING.

There is no plant that responds so readily to the judicious use of fertilizer as tobacco; this is especially true where quality and yield are taken into consideration. Tobacco is a very heavy feeder, and to get the best results the soil should be well supplied with available plant-food. Practically all the snuff-tobacco growers use a considerable amount of kraal manure for their soils, varying in quantities from a few tons to as many as twenty tons of well-rotted manure per acre.

When kraal manure is not available in large enough quantities to broadcast over the field, a small amount is placed in each hole and thoroughly incorporated with the soil before planting. The usual custom is to spread the manure over the field and either harrow or plough it in.

Successful crops have also been grown without the application of kraal manure by the use of Government guano and complete commercial fertilizers. In this case a small amount of complete fertilizer or Government guano is mixed with the soil in each hole before planting.

It is customary with the best growers to top-dress the plants once or twice during the growing period with either Government guano or nitrate of soda. A small amount is distributed near each plant and worked into the soil. This top-dressing of plants is done even when a liberal application of manure has been made.

It will be seen by the foregoing that nitrogen is the chief element applied to the plant as nitrate of soda contains 15 per cent. of nitrogen, Government guano varying from 9 per cent. to 11 per cent., and kraal manure under 1 per cent. Although tobacco uses up a considerable amount of potash during its growth, the growers apply no potassic manure; this may be due in a measure to the fact that the soil in this area contains a fair amount of potassium derived from the felspar in the soil.

Phosphorus is also a neglected element and is not applied to any great extent to tobacco. No continuous fertilizer experiments have been made with tobacco in this area with different forms and amounts of phosphorus, nitrogen, and potassium, so it is impossible to give any définite rule as to the best amounts of these elements to apply.

Intending growers of snuff tobacco must realize that it is essential to manure and fertilize freely to get the desired strength and colour of the product. Unless this is done the resulting leaf will be worthless for the snuff trade, and must be sold for what it will fetch as dark tobacco. Many cases have been seen where the crop has been under-fertilized, especially with the beginner who does not realize the necessity of heavy fertilization. Apart from the mechanical composition of the soil it is essential to fertilize heavily to produce a dark, strong, heavy leaf suitable for the snuff trade. The lighter soil will require more manure than the heavier ones to procure the desirable results; even then the leaf is generally lighter in texture and often in colour.

TOPPING AND SUCKERING.

After setting the young plants out, the field is kept in thorough cultivation, first with a single walking cultivator when the tobacco is small, and finally by hand-hoeing when the plants have attained a fair size.

Topping (or removing the seed-head) is a very important operation in the growing of all heavy types of tobacco. There is no set rule that can be applied to this work as the judgment of the grower must be relied upon, depending on the season and general growth of the individual plant. It is better to top a little low than too high; tobacco topped too high produces more leaves of an inferior quality, being thinner in texture, smaller in size, and less uniform in length and breadth, with very little (if any) increase in yield of leaf per acre. There is a tendency with beginners to leave too many leaves to the plant, with a resulting loss in quality and grade. The best growers leave from twelve to fourteen leaves to a well-grown plant and a corresponding smaller number on a weak plant.

The best time to top is when the seed-head is long enough for one to see clearly the actual number of leaves that should be left on the plant, otherwise it is difficult to determine the number of leaves. The seed-head should never be left on the plant until it becomes woody, as it is then difficult to remove, apart from the resulting loss in plant-food furnished to the seed-head.

As soon as the tobacco plant is topped, young shoots or suckers start growing from the axil of each leaf, being an endeavour of the plant to reproduce seed again. These suckers must be removed as soon as possible before they become large. It is necessary to sucker the field at least twice during the season, depending on the growth of the suckers. Suckering is the most expensive part of field operations

in the growth of a tobacco crop, and sufficient labour must be available at the right time.

CUTTING.

Tobacco for snuff purposes should be cut when ripe. This ripening can easily be detected by the change in the leaf from a dark-green colour to a decided mottled yellow; the leaf also becomes thicker and more brittle. Dr. Garner, in his bulletin on "Principles and Practical Methods of Curing Tobacco," describes the ripening of the leaf as follows:—"When the reserve food supply of the mature leaf is no longer required for the nourishment of other parts of the plant it is deposited in the leaf tissue in the form of starch granules, while the green colouring matters are dissolved and carried to the younger growing parts. This interchange causes the appearance of the light-tinted flecks so characteristic of the ripe leaf. Moreover, the accumulation of the starch granules in the leaf causes it to become brittle so that it snaps when folded between the fingers."

FIG. 11.—Type of Barn used for Curing Snuff Tobacco.

Tobacco cut when green does not colour out well, lacking quality as well as weight. It is advisable to cut the plant rather in a slightly overripe condition than when too green, especially for this class of tobacco. In cutting, the whole plant is removed by severing the stalk with a sharp knife just above the ground, care being taken to handle the plant carefully to avoid breaking the leaves. The plants should not be left too long exposed to the hot sun as burning of the leaves will take place. Do not cut immediately after a heavy rain as most of the gummy matter will have been washed off the leaves.

As soon as the plants have become wilted sufficiently to handle without undue breaking of the leaves they are taken to the curing-barn.

CURING AND CURING-BARNS.

It is a common practice among snuff tobacco growers to "green sweat" the tobacco for about four days before finally hanging it up

in the barn. The plants are placed either in the barn or in the field in shallow heaps, covered with grass, and left until the green leaf turns to a decided yellow colour.

It is claimed that tobacco treated in this manner cures out a better colour than when the plants are hung up directly in the barn. It is very doubtful if this process does produce a better coloured product in the ultimate cured leaf, as the colour is first determined in the field by the soil conditions, manurial treatment, and finally in the second curing process. Unless care is taken in "green sweating," the tobacco is liable to heat very quickly in the pile and become rotten. A number of new growers have suffered loss this season

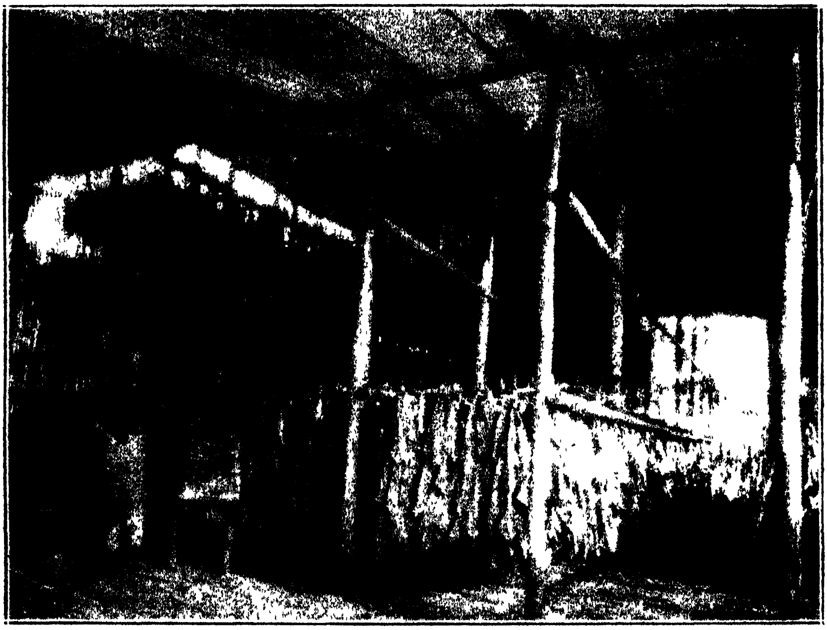

FIG. III.—Interior of Curing-barn.

through this cause. Furthermore, the tobacco is more liable to bruising and general breaking of the tender leaves; a leaf once bruised can never be cured out a good colour. The only advantage in "green sweating" is to hasten the first stage of air-curing by changing the leaf from a green to a yellow colour, but it is doubtful if it can generally be recommended as a good practice; if done, the plants should be left less than two days in the stack. Dr. Garner states:—"The amount of colouring matter in the leaf probably depends chiefly on the conditions as to the soil, fertilizers, and climate under which the plant is grown, and so is not under the control of the operator in the curing."

All the tobacco in this area is air-cured, the whole plant being hung up on sticks, about six plants placed on each, in the barn. Different methods are applied in the attaching of the plants to the

stick, some growers using string, while others drive nails through the stick to which the tobacco is attached.

The leaf gradually changes from a yellow colour until it becomes dark brown, depending on the conditions under which the leaf has been grown and, to some extent, on the climatic conditions existing at the time of curing It must be remembered that the curing process is not merely the drying out of the leaf, but a series of complete changes, including oxidization which takes place in the leaf during the process.

The tobacco remains on the sticks until the midrib of the leaf is *thoroughly* dried out; the last part of the leaf to become dry is the fleshy part of the butt-end of the midrib. The barns in use do not lend themselves to any control as to the moisture conditions, so the grower has to rely on suitable weather: fortunately the climatic conditions at the curing period are favourable, and very little or no loss occurs in this district.

When the dry leaf becomes "in order," or in a moist, pliable condition for handling, the whole plant is taken down and bulked into heaps in the barn and covered with a sail. Care must be taken that this heap does not overheat, it being advisable to start stripping or removing the leaves as soon as possible.

Figure II shows a type of curing-barn for curing snuff-tobacco that is in general use throughout this area. It will be noticed that the roof is made of corrugated iron, with a gentle slope for the rain to run off. The sides of the barn are thatched with river reeds, or failing this with ordinary thatching grass. The whole of the uprights are made with gum poles embedded at the base in concrete, while ordinary timber is used for the cross-pieces which are bolted to the main upright gum poles. The average barn has three or four tiers of tobacco. No detrimental effect has been observed on tobacco by the use of iron as a roof. The actual cost of the barn shown in Figure II was given as £80 for material and labour in erecting, no charge being made for the farmer's time. This type of barn has proved eminently suitable for conditions in this area and is undoubtedly economical in construction.

Figure III is the interior of the barn, showing the method of framework and the tobacco on sticks during the curing process.

STRIPPING AND GRADING.

When the leaf has been thoroughly cured and is pliable enough for handling, it is removed from the stalk and graded into different grades according to length, quality, and colour. Unfortunately, there is no definite standard for the different grades, each grower being guided by his own discretion. This lack of uniformity in grading has caused endless trouble both with growers and buyers, each one claiming that his grading is the correct one.

It must be remembered that the snuff trade is different from the general heavy tobacco sold for smoking purposes, as the tobacco is sold direct to the ultimate consumer as whole leaf in retail lots; for this reason considerable care must be taken in grading the product. Three grades of leaf are made up by the growers, chiefly depending on length of leaf. It is generally considered that No. 1 leaf is 22 inches

or over in length, good colour and strength, and free from broken leaf. No. 2 grade is tobacco from 16 to 18 inches in length, with good colour and strength and free from broken leaf. No. 3 grade is termed "scrap," and is composed of all broken and undersized leaf. These grades are only arbitrary and vary considerably with the individual grower. One of the largest growers states that his grading depends only on the quality of leaf and not on length, which varies from 16 to 22 inches in the same bale, only two grades being made—No. 1 and scrap. This question of uniformity of grade should be decided as soon as possible, and probably the only solution will be found in the co-operation of all snuff-tobacco growers in this area, the chief object being the standardization of product.

As stated previously, the leaves are stripped, placed into their respective grades, and made into small hands or bundles ready for fermentation.

FERMENTATION AND BAILING.

When the tobacco is made into hands it is bulked down in stacks on boards in the barn. The bulk varies considerably in height according to the amount of tobacco ready to ferment. The hands are carefully placed so that all the butts of the leaves are on the outside of the pile; generally the piles are made two leaves in width, the hands arranged with the tips of the leaves overlapping in the centre of the heap.

Boards are then placed on the top of the pile and finally weighed down with stones and covered with sacking or a sail. This process is of the simplest, as growers do not even use a thermometer to gauge the rise of temperature in the piles; however, it is not advisable to heat higher than 120° F. The whole process of fermentation is determined by the experience the grower has at his command. When the temperature rises too high, the pile is broken down, the hands shaken out and repacked, this time with the top and bottom of the stack placed in the centre.

The leaf must contain just the right amount of moisture to ferment successfully; should the leaf be in too dry a condition the bulk will not heat sufficiently. On the other hand, if too wet the temperature rises very rapidly and there is a danger of the centre of the pile becoming rotten unless care is taken to break down the pile and repack. Under no consideration should water be applied direct to the leaf, either at the time the plants are taken down for stripping or when fermenting. The bulk of the snuff leaf does not go through a high process of fermentation; in fact, buyers in some instances have stipulated that fermented leaf is not required.

After fermentation has been completed the tobacco is made into small bales holding about 60 to 100 lb. The method of bailing is as follows:—A grain bag is cut down lengthways both sides and the leaf carefully packed in this covering, with the butt-ends of the bundles showing at each end. The leaf is tightly wrapped in this covering and a piece of the sack is sewn on to each end, covering the exposed butts. Care should be taken to make a tight bale, especially when the tobacco is sent long distances, as the natural drying out of the leaf will cause the product to become loose in the bulk and the leaf broken. This is a general description of the type of bale used for this class of tobacco, the trade generally demanding a small package.

SUMMARY.

This briefly outlines the general practice of producing snuff tobacco in the De Kaap Valley, Barberton. This tobacco is sold throughout the greater part of the Union for the native trade, practically the whole output being ground into snuff. The chief factors to consider in producing this type are as follows:—

(1) Suitable climatic conditions.

(2) Preferably a heavy type of soil.

(3) An abundant supply of available plant-food, especially nitrates.

(4) Suitable varieties.

This concludes the discussion on the production of this tobacco, and it must be remembered that although it is a comparatively easy crop to grow, care must be taken in every step to produce the right kind of leaf, especially in view of the fact that the product is sold direct to the ultimate consumer in the form of leaf.

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HOW FAR DOES SUPERPHOSPHATE PENETRATE SOIL?

By THOS. D. HALL, M.Sc. (Agric.), Chemist, School of Agriculture and Experiment Station, Potchefstroom; and

P. KAMERMAN, M.Sc., late Lecturer in Chemistry, Potchefstroom University College.

WHEN a farmer has invested some of his hard-won gold in superphosphate he is very much interested in what happens to it after he has applied it to his lands. Especially is this the case when his crops have been a failure due to drought, locusts, or disease. The chemist has been able to comfort him by telling him that when once he has put down his superphosphate, the only way in which it will be removed from the soil is by crops. This view has been based largely on the "Phosphorus Balance-sheet," which was drawn up by the Rothamsted Experiment Station some years ago. All the phosphates applied to the Broadbalk wheat plots in six decades could be accounted for, as all the crops taken off the land had been analysed and also the amount of phosphates escaping in the drainage water was known. The amounts of phosphate which it was calculated would be found in the soil, and the amounts actually found, agreed almost to a pound.

The drain gauges at Rothamsted and the lysimeters at Cornell University show that only small quantities of phosphates escape from the soil in drainage water. It is a well-known fact that phosphates are fixed by the soil, but is it right to assume that they will be as well fixed on all types of soil as in the heavy clay loams of Rothamsted and Cornell? Will phosphates not penetrate a light, sandy loam to a much greater depth? Will they not go far deeper into an irrigated land than a dry land? The senior writer has observed some wonderful results from top-dressing lucerne on a good loam with superphosphate. The roots of the lucerne were six to eight feet deep. On the other hand, he has observed no benefits to young barley with roots not six and seven inches long when top-dressed with superphosphate. The general experience is that it is better to apply the phosphates before planting annual crops.

The Texas Experiment Station (1) has satisfactorily answered some of these questions for the soils of that State. Representative soils were taken from all over the State to the number of 1,402 and superphosphate was applied to them at the rate of 2,300 lb. per

acre. After standing twenty-four hours, the soil in cylinders 14 inches deep was leached with water equivalent to 25 inches of rainfall. It was found that 10 per cent. of the surface soils and 28 per cent. of the sub-soils had a fixing power of over 80 per cent. The lighter sandy soils did not fix the phosphoric oxide as well as the heavier soils. In their conclusions it is stated that: "Heavy rains would be required to cause a loss of phosphoric acid even from soils of low fixing power, under natural conditions. A rain of three or four inches within ten days might cause a loss of 3 or 4 per cent. of the water soluble phosphoric acid applied to light sandy soils with sandy sub-soils, having a fixing power of less than 50 per cent."

It was also noticed that there was a definite ratio between the percentage of phosphoric acid fixed and the amount of iron oxides and alumina. These substances had a far greater effect on the amount of phosphoric acid fixed than had lime compounds As the percentage of iron oxides and alumina increased, so did the percentage of phosphoric acid fixed increase. Hall and Vogel (2) in some preliminary work in this laboratory also ascertained that the soil with the most iron oxide alumina fixed the most phosphoric oxide.

The work of Wiley and Gordon (3) shows, however, that phosphoric acid absorbed by the colloids of alumina and ferric oxide, although it cannot be leached from the soil, is still available for plants. In the Texas work 2,300 lb. of superphosphate were applied per acre. This is about ten times as much as is applied in practice. If, according to their results then, the soil leached within twenty-four hours of stirring in the phosphate in the top 7 inches showed only a 10 per cent. fixation, it is likely that in practice and under a very much lighter leaching no phosphate would escape the second foot.

The Potchefstroom Experiment.

No attempt has been made to investigate the many questions raised in this paper. During the season 1924-25, however, an endeavour was made by the writers to ascertain to what depth superphosphate was washed in the soil of the field husbandry experimental plots on a range a few yards north-east of the present greenhouse. A sample of this soil type, a brown loam, overlying andesite and shale, taken a few yards from the plots used, showed an iron oxide alumina content of 18.68 per cent. in the first foot and 35.46 per cent. in the second foot. The second foot is very gravelly and consists largely of limonite concretions. In practice on this soil superphosphate has, however, given as good returns as bonemeal and more cheaply, in spite of the high fixation which would be expected. It is stated by some fertilizer companies that superphosphate has a tendency to become fixed in or near the surface of the soil, whereas bone phosphate tends to work downwards and so encourages the formation of deep roots, which give the plant a wider area from which to draw moisture during dry spells, and promote evenness of growth. Whether there are data to support this view, the writers cannot say, but the latter portion of the foregoing sentence has been found to be just as applicable to the plots receiving superphosphate on this soil type during the past eight seasons.

The range chosen for our experiment was cut up into eighteen one-thousandth acre plots. To ten of these 25 lb. of superphosphate was applied, and raked in. The plots were kept free of weeds and left exposed to all weathers. The superphosphate was applied at the rate of 25,000 lb. per acre and supplied thus 4,375 lb. of citric acid soluble phosphoric acid. This is more than one hundred times a normal dressing, but it is not analytically possible to work with any degree of correctness when superphosphate is applied at the rate of only 150 lb. to 200 lb. per acre.

DISCUSSION OF RESULTS.

From the data contained in the table of the appendix the following observations can be deduced:—

Three weeks after the application of the superphosphate at the rate of 12½ tons per acre, and after 1.1 inches of rain had fallen, the citric acid soluble phosphoric oxide had decreased in the first two feet of soil by 64.2 per cent. After five weeks and 2.45 inches rainfall it had decreased in the first and second foot together 74.6 per cent., and after eight months and 31.44 inches of rainfall, it had decreased 94.9 per cent. After the first three-week period, there was six times as much citric acid soluble phosphoric oxide in the second foot of soil of the fertilized soil as there was in the control; after five weeks nine times as much, and after eight months not quite five times as much.

The next point to ascertain was, how much of the phosphoric oxide had been washed down below the second foot and how much had been fixed by the soil in the first two feet. This was done by determining the total phosphoric oxide in fertilized and unfertilized soil.

In the first and second foot of the soil there was fixed 14.8 per cent. of the total phosphoric oxide applied. Of this amount 8.5 per cent. was fixed by the first foot of soil. Of the total amount applied 85.2 per cent. had been leached below the second foot.

The amount fixed represents 3,700 lb. of superphosphate. This soil thus has in its first two feet the capacity to fix as much superphosphate as would normally be applied in twenty-five years. No allowance has been made for the phosphates which crops would remove, which would roughly be equivalent to about 2,000 lb. of superphosphate in the twenty-five year period.

CONCLUSION.

When superphosphate was applied at the rate of 12½ tons per acre to the soil herein described, 85.2 per cent. was leached below the second foot of soil. The amount fixed in the first two feet, however, 14.8 per cent. represents 3,700 lb. of superphosphate, an amount that in ordinary farm practice would be applied over approximately twenty-five years. The first foot alone fixed 8.5 per cent., which is equivalent to 2,000 lb. of superphosphate, an amount it would normally take about thirteen years to apply to one acre. It would seem that in this soil type there need be no fear of loss of superphosphate by it being leached below the reach of common crops.

Appendix.

Time Intervals, Rainfall, and Phosphoric Oxide Percentages.

Treatment and Plot Nos.	Depth of Sample.	Interval before Sampling.	Rainfall on Plot.	Percentage Citric Soluble Phosphoric Oxide.	Total Percentage Phosphoric Oxide.
Control I	1 ft.	At start	Nil	0·00165	
„ I	2 ft.	„ „	„	0·00093	
Fertilized II	1 ft.	„ „	„	0·11102	0·1166
„ II	2 ft.	„ „	„	0·00093	
„ III	1 ft.	3 weeks.	1·1"	0·0344	
„ III	2 ft.	3 „	1·1"	0·00575	
Control IV	1 ft.	At start	Nil	0·00169	
„ IV	2 ft.	„ „	„	0·00095	
Fertilized V	1 ft.	5 weeks	2·45"	0·0178	
„ V	2 ft.	5 „	2·45"	0·0083	
Controls	1 ft.	8 months	31·44"	0·00155	0·0141
6, 7, 8	2 ft.	8 „	31·44"	0·00084	0·0129
Fertilized	1 ft.	8 „	31·44"	0·00437	0·0234
9, 10, 11	2 ft.	8 „	31·44"	0·00128	0·0198

The results were calculated on moisture-free soil. As the samples were taken by digging to the two-foot depth, a thousandth-acre plot could not be sampled more than once. The results after eight months are on composite samples of three plots. The method of analysis used was the following:—A representative sample was taken and of this 300 grm. of soil was shaken for half an hour with 1,000 c.c. of 2 per cent citric acid solution, which was then put through a filter candle, the first part of the filtrate being discarded. An aliquot of the filtrate was then evaporated to dryness on a water bath, and the residue moistened with HCl, and again evaporated to dryness. This treatment was repeated. The phosphoric oxide was then determined by the Molybdate method of Marchand described in the *South African Journal of Science*, Vol. 15, p. 357, 1919. The total phosphoric oxide was determined by the official fusion method of the A.O.A.C.

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THE SELECTION OF RAMS FOR STUDS AND FLOCKS.*

By W. S. VAN HEERDEN, Sheep and Wool Expert, Department of Agriculture.

THE above is a subject that for generations has been occupying the minds of sheep breeders. The selection of unsuitable rams has been the cause of ruining some otherwise very excellent flocks. On the other hand, to judicious selection must be credited the wonderful improvement in Merino sheep during the last century. A little over a hundred years ago sheep in Australia cut an average of about three pounds of wool after twelve months' growth. To-day any sheep farmer has every reason to be dissatisfied if his flock cuts less than an average of eight pounds of clear, good yielding wool. Indeed, a great many flocks, both here and in Australia, yield very much more. The three great means of improvement are: good management, the use of suitable rams, and the systematic culling of all undesirable ewes. Departure from any of these dooms to failure any attempt to improve the flock.

Constitution and frame are the first essentials in the selection of rams, both for stud and flock purposes.

Frame.—The frame should be large, with a good, straight, broad back and wide, well-sprung deep ribs, showing a roomy belly. The chances are that a ram with a roomy belly will breed ewes with an abundance of milk and able to develop their lambs well during the gestation period. There should be an absence of small girth round the heart section or devil's grip behind the shoulders, as this does not give the heart and lungs sufficient scope to do their work properly—thus affecting the constitution of the sheep. The neck should be thick and well set into the shoulders; avoid a ewe neck. The hindquarter should be broad and straight—not goose-rumped; this is a sign of good mutton qualities.

Legs.—The legs should be straight. A cow-hocked or sickle-hocked, or knocked-kneed ram should be avoided in all circumstances. These are hereditary faults, and a whole flock can be ruined by the use of such rams. Besides, the rams themselves cannot walk properly to search for their food.

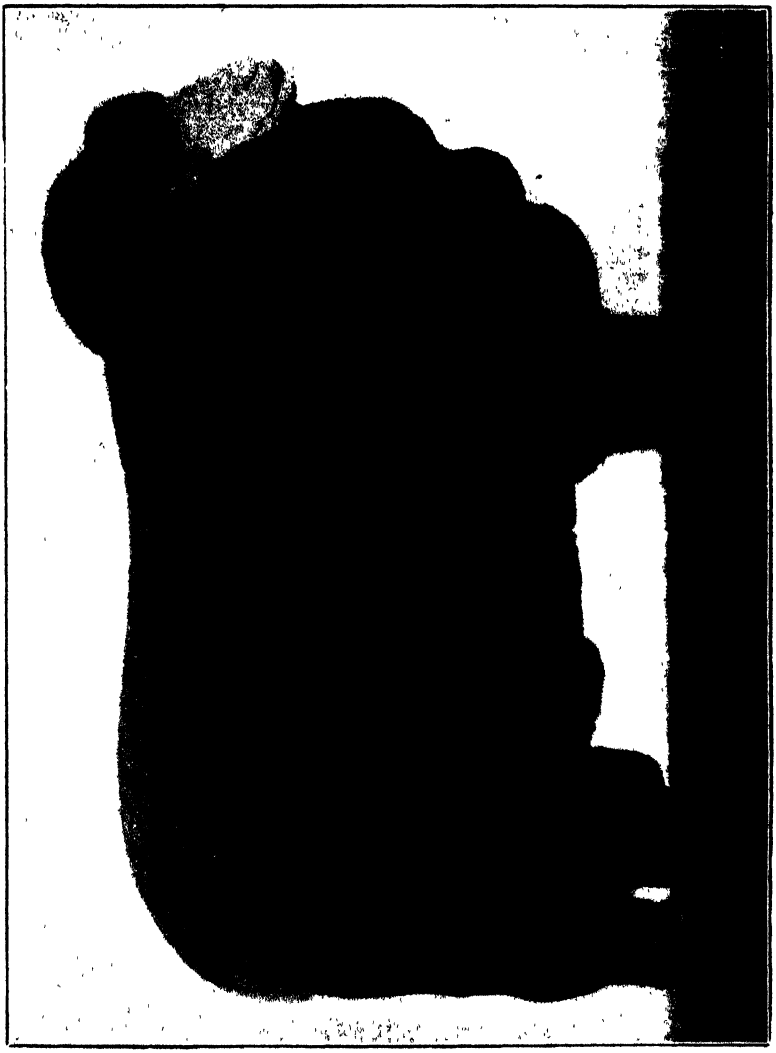
Feet.—The necessity of good feet is also obvious.

Bone.—The bone of the leg should be thick, showing a great deal of quality. Do not mistake wool on the legs for a thick bone. The thin-boned ram should be avoided; he seldom has constitution. The very thin bone (speekies bene) is usually a sign of one or two things: excessive in-and-in breeding or a very weak constitution.

* Published originally in the February, 1923, number of this *Journal*.—EDITOR.

Testicles.—There should be two fairly large testicles of more or less even size.

Head, Horns, and Face.—The head, horns, and face of a ram are the things which carry more weight with the Merino lover than anything else. The reason is that these three things combined are



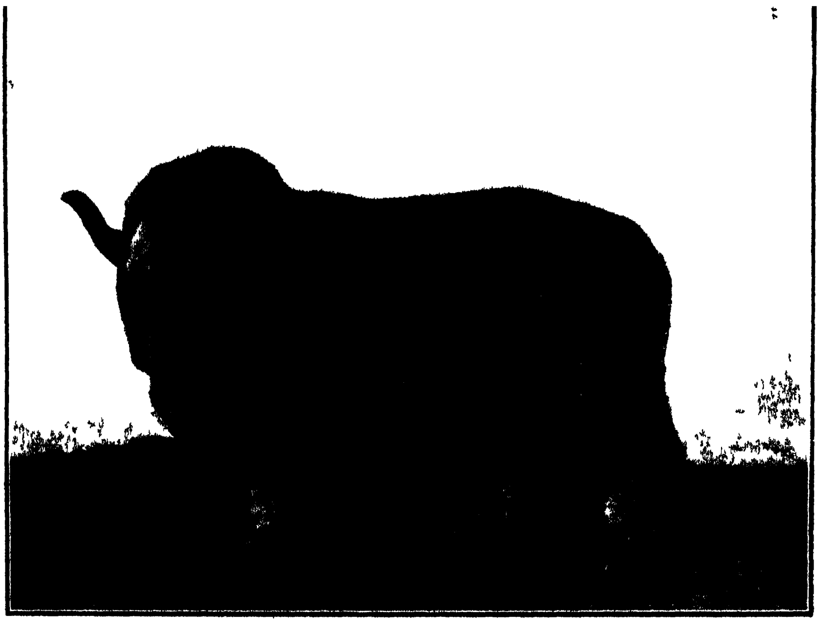
A very desirable type of a Merino Stud Sire.

usually indicative of character, temperament, constitution, and in fact everything which the sheepman loves.

Breeders and buyers are warned against rams with wooolly faces; besides being ugly, the woolly-faced sheep gives a great deal of trouble, especially in country where there is an abundance of grass-seeds (steek gras) or undulating country with holes or precipices.

The open face of the Wanganella sheep is one of the characteristics that make it such a popular type. Some Tasmanian breeders have, to a very great extent, succeeded in breeding sheep with open faces. One finds to-day, however, that some Wanganella breeders have been very careless about the faces, and have lost this most beautiful quality. The writer would not countenance a ram with a closed face, no matter how good he might be in other respects: such a ram is apt to throw a hundred lambs, all—or a great percentage—of which are likely to have the same undesirable defect.

Horns.—Horns are a sign of a good or bad constitution. They should be of a yellowish amber colour, large, thick, and well serrated:



Plain-bodied type of Merino.

the colour is a sign of health, and the serrations one of character in wool (there are many exceptions to this). A thin horn is a sign of a weak constitution. The bend of the horns should not be less than 1½ inch from the jaw; they should not be too wide or too narrow.

Eyes.—These should be large and kind, showing good temperament.

Ears.—Fairly thick and large. Thin, papery ears are a sign of weak constitution.

Mouth.—The teeth in the bottom jaw should fit nicely in to the point of the pad of the top jaw. The long or the short under-jaw (overshot or undershot) should be avoided, as they are very prepotent and hereditary faults, and thus a disqualification. A sheep having either of these faults cannot feed properly.

The first essential of a Merino sheep is to grow wool as against mutton; and it is much easier to put wool on to sheep than to

grow mutton. Experience and observation show that in three or four generations a very useful Merino wool can be acquired by a class of sheep originally a little better than bastards; that is, having a good foundation to build upon as far as constitution goes. But growing wool on a small, weak-constitutioned sheep is a very precarious business: such an animal cannot be expected to carry a heavy pack for twelve months and do well. Of the two evils, rather commence with a good constitution and bad wool.

Purity of Blood.—In all circumstances adhere to sires of recognized pure origin. By a pure strain is meant one which has *vindicated* and established its prepotency, brought about in the first place by in-and-in breeding, and after that by careful excessive line-breeding through selection within the same families divided only by a few generations.

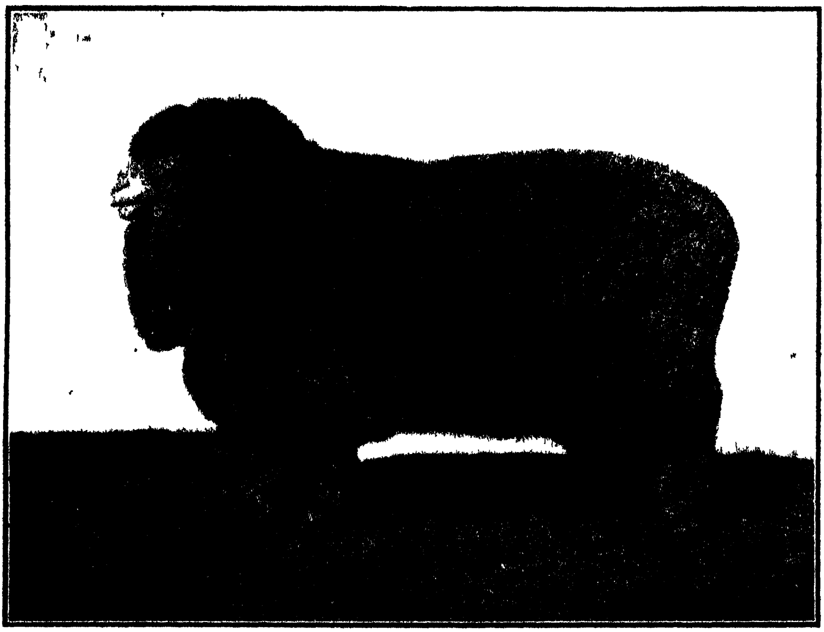
The progeny of such in-and-in-bred and line-bred animals naturally have the aptitude to reproduce their like to a very great extent. In other words, they have become prepotent: their chance of breeding true is very much greater than that of an animal which is the offspring of a cross of, say, a Merino with an English mutton breed such as the Suffolk. In the latter case, the blood of the Merino may not necessarily be stronger than that of the Suffolk, with the result that such a half-bred or cross-bred animal is likely to throw anything from a Merino to a Suffolk, according to Mendel's theory of dominant-hybrid and recessive characters, which, as a general principle of breeding, can safely be accepted. For this reason it is advisable not to use sires of mixed blood.

The question now arises: when is an animal cross-bred?. The writer is certain that on this point many noted breeders and prominent writers will be at variance with him. The following table shows the writer's ideas of grouping of sheep:

Breeds.	Merino Types.	A few Merino Sub-types	A few Merino Strains.
Merino	Rambouillet	Bundemar, Wanganella, Grassdale, Zuurplaats	Sir Charles, Magician, Emperor, Marmion, Donald Dinnie
	Tasmanian	Hillmoor, Highland Home, Belle Vue, Winton	
	Vermont	The types of these Breeds are of little importance to South Afrca.	
English Long Wool...	Lincoln		
English ShortBreeds	Suffolk		

Now, crossing any of the different sheep under the heading "Breeds" would be an out-and-out cross, and certainly a very undesirable method, unless the object be to raise fat lambs. Crossing of any two Merino types under the second heading would be a type-cross and certainly a method of breeding that has a great many drawbacks and few advantages.

Breeding from different animals under the next heading, "Sub-types," is a method that has been practised in Australia for the past seventy years, and although much less of it is done amongst studs to-day, the question arises as to which studs can claim absolute purity of blood. Of course, Merino types are the result of line-breeding, and what the type has become has depended solely upon climatic conditions, environment, and the breeder's ideas. Only a few year ago famous South Australian studs introduced famous sires from New South Wales, such as Donald Dinnie, Dandie Dinmont, Lord Charles, Prince Charlie, etc., with the greatest success. Long before this the foundation of some of the most famous South Australian studs was a mixture of New South Wales and Tasmanian sheep.



An overdeveloped or wrinkly type. Considered excessive even in a sire.

But the management of these studs was in the hands of very skilful flockmasters. The mating together of different types and sub-types is a method practised very successfully in South Africa to-day.

The foregoing remarks regarding the inter-crossing of sub-types also apply to strains, because strains are bred within types.

When is a sheep cross-bred? According to the writer's idea only when breeds are crossed; for instance, the crossing of Merino and English Long Wool, or any of the members of the family belonging to one of these distinct breeds. But breeding from two distinct members within the Merino breed is no cross, such as Tasmanian and Rambouillet, because the pogeny still remains a Merino—call it by any other name you like, such as a type-cross. A racehorse stallion brought from one stud to another, both of which cannot show any blood in common for the last two hundred years, does not breed half-bred horses. Whether this method of crossing different types

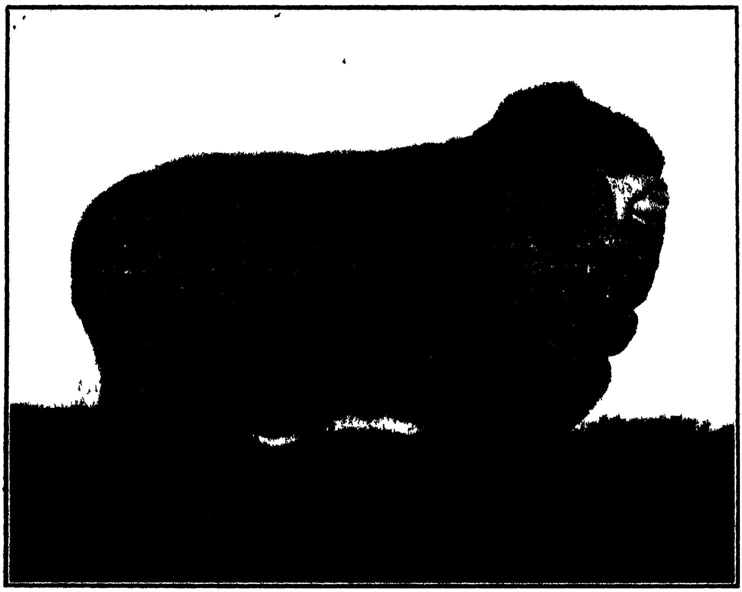
of Merinos is advisable and whether it is possible for a farmer to improve his stud by so doing, are dealt with later. The fact remains that the progeny of such type-crosses cannot possibly be as prepotent as that of the ram bred within the same sub-type and strain for about fifty years, and farmers are advised to buy from a pure type or sub-type, if possible. If not procurable, they must get the next best sheep.

Regarding the advisability of crossing of Merino types and sub-types for improvement, there certainly is a difference between the crossing of types in studs and crossing types of flocks. The writer has seen a wonderful improvement in several old Rambouillet studs in South Africa brought about within a few years by the introduction of Wanganella or South Australian rams, which has resulted in great improvement in length, staple formation, and colour. The writer would not, however, advocate the use of such progeny for stud purposes until the new type had been fixed and prepotence established.

The breeder would have to continue using pure-bred sires for a considerable time until his type is fixed. The using of rams of a different family or type from the one the stud-breeder has, necessitates breeding away from his own type and establishing a new one considered nearer to perfection than the one he originally had. It is a slow process, and can only be accomplished by careful selection and mating. On the other hand, if a man has a type of good commercial sheep, there is no reason why he should change it, provided he is able to obtain the desirable sires either within his own type or from one closely related to it.

The question that puzzles many breeders to-day is whether a type-cross of, say, Grassdale and Hillmoor, is desirable in studs. There is decidedly no reason to do this, seeing that good sires may be obtained from both these studs. On the other hand, as both these studs have established prepotency in regard to plain body, open faces, and good robust constitutions, also good, commercial, bold-stapled, shafty wool, and that these are characteristics prepotent in both, why should the resulting progeny not possess the same good qualities, considering that they are prepotent in both their sires and dams? No two studs, however, are exactly alike in every respect, and the progeny will have certain characters not applicable to both, making the stud somewhat uneven. There is, on the other hand, the question of Mendel's reversion when two breeds are crossed; but the writer does not think that this applies in crossing types such as Hillmoor and Grassdale in Merino sheep. If so, the percentage will be very small. He feels certain that a very fine sheep could be evolved through the crossing of such two types, and that a great many big breeders will agree with him. He looks forward to the day when no longer shall the names Wanganella and Tasmanian be known in South Africa, but studs shall be known by the names Hillmoor, Highland Home, Grassdale, Zuurplaats, Rolfontein, Koloniesplaats, etc. For some reason or other, the Tasmanian, as valuable a sheep as any other family we have, has fallen into disfavour with some breeders, and the farmer will scorn to buy Hillmoor rams, "because they are Tasmanians." Emphatically, they are not Tasmanians; taken as a type they could pass as Wanganella type any day. All good breeders have more or less the same ideas as regards the perfect sheep, and have evolved an animal as nearly

like the two types as possible, and such similarity has been made prepotent. The Tasmanian was a small short-legged sheep with very heavy wrinkles and a short, completely covered-up woolly face. The original Wanganella, on the other hand, was a long-legged, thin-boned, slab-sided, gaunt-backed sheep very like a springbok, but for his horns. Where are these extremes to-day? Is it not a fact that one could select several hundred Hillmoor ewes, run them on Grassdale veld for twelve months, and defy any man to pick them out from the mob? These two studs, Grassdale and Hillmoor, are taken as instances; there are a great many others of a similar nature.



A developed type of Merino.

With regard to flock sheep, many undersized, developed close-faced and short-woolled ewes, are claimed as being descended from the original Tasmanian. In such cases the buying is advised of large-framed, plain-bodied, and long-woolled rams with open faces, irrespective of their type, whether Zuurplaats or Hillmoor; the result is sure to be successful. Why struggle to improve such sheep slowly with rams only a little better than themselves, by breeding from rams of practically the same type, when the desired improvement can be brought about within a few generations? Of course, there will be a fairly large percentage of culls for several years before the flock is an even one.

Quality in Rams.—When selecting rams for both flock and stud purposes, the farmer must bear in mind that whatever improvement there is to be in the future generations must come from the ram's side. Therefore, in all cases it is advisable to breed up to the rams, which must be of a higher standard than the ewes. If the ewes are lacking in length or quality, it is the farmer's duty to see that these two essentials are not lacking in the rams he selects. Length and

quality are the two most essential things in merino wool. They are being sought after by buyers every day, and they are the two main factors in securing big prices for wool. Another important point is condition or yield of the clip, but this will largely depend upon the treatment given the sheep and the climatic conditions under which they grow their fleece.

FLOCKS MATED COLLECTIVELY; STUDS SINGLY.

In selecting flock rams the farmer should be very careful to get an even line as far as frame and, especially, wool go. It is a great mistake to use strong-woolled and fine-woolled rams in the same flock, because it results in an uneven clip, and unevenness must be guarded against as much as possible. Stud rams are usually mated singly, and the breeder must be careful not to mate extreme strength with strength which is likely to go too strong and straight in the progeny. Mating fine with fine is dangerous in so far that the progeny will be over-fine and likely to go very short and lean stapled, being light cutters. In selecting both stud and flock rams, the buyer should always aim at the qualities most wanting in his own ewes, and so improve them in this respect.

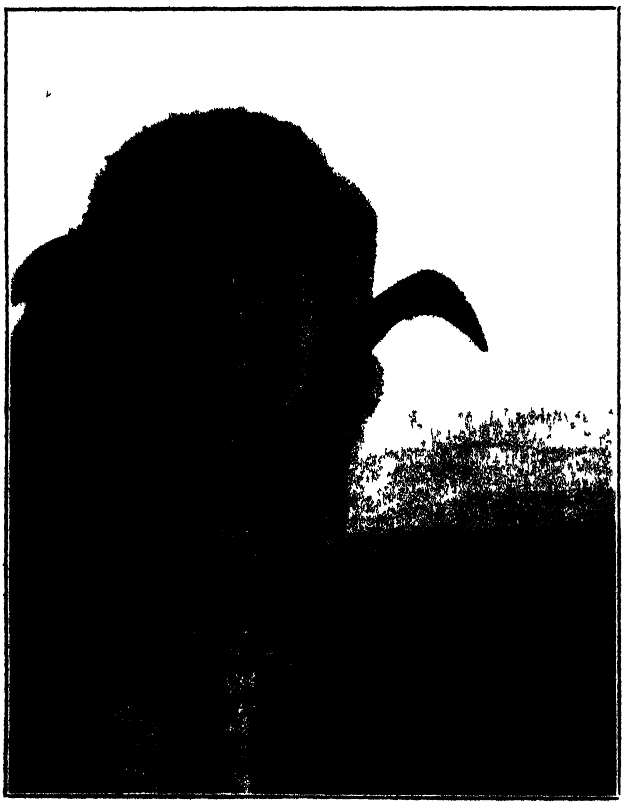
CHOICE BETWEEN LENGTH AND DENSITY.

One is sometimes asked which of the two, length or density, is most important. All extremes in Merino wool are harmful. Extreme length must of necessity sacrifice density, and the wool will be long and slack and the backs inclined to fall open when the wool becomes long, thus picking up dust and letting in water. The chances are also that such wool will become very dry, harsh, and mushy in its tip. In this class of sheep good bellies and points are exceptional. Extreme density will always go hand in hand with shortness in staple and wrinkles, and the wool is likely to become very heavy in condition. Acquire the medium in wool, and if there be erring let it be on the side of length, and rather sacrifice a little density. Such wool with good combing length will always sell well, and usually growing length of staple is a less strain on the sheep's constitution than dense heavy wool. This is important and should be borne in mind when selecting rams.

STRENGTH OR FINENESS IN FLOCK RAMS—COMMERCIAL WOOL ESSENTIAL.

Strength of wool, with a great deal of quality—that is, well-defined crimp, together with all other good properties found in wool—has in the past been recommended by experts in the selection of rams. There were good reasons for this, amongst others being the fact that the average flock in this country was on the developed side with short, dense, fine wool, and rather heavy in condition. This had to be remedied, and, therefore, the opposite to this was fostered, and it is due very considerably to the strong-wooled craze that the Merino sheep has been improved in South Africa, and we rank to-day amongst the prominent fine-wool producing countries of the world. With it came length, plain body, and a sheep with a very much improved constitution. To-day, buyers often complain about our Merino wool getting too strong. This may be so in individual clips, but, generally

speaking, there is a great deal of room for improvement in regard to length and bulk of fleece. The majority of clips which appear too strong for buyers are those of stud-breeders who are breeding rams for buyers looking for strong wool, and it is to be expected that their own clips should be on the strong side. These few stud-breeders are out to improve the length of the staple in the majority of average and weak flocks. The expert advice for strong wool was not in the first place given with the object of making all the Merino wool in South Africa strong, but to improve the length of staple, and it is well known that strong wool and length go hand in hand, as also do fine and short.



A typically good Merino Head, Horn, Face, and Front.

Then also a great deal depends on the altitude, rainfall, and nature of veld on which the farmer runs his sheep. In Karroo country, in good seasons, it is not difficult to grow a good average length in the flock, although such wool is a medium to fine. In bad seasons, however, such as we are subject to, it is found that the medium or fine wool will be very short and wasty, whereas the strong wool will still be of a good combing length, and plain-bodied sheep carrying strong wool are usually better able to weather the bad times. In grass-veld country, particularly the colder portions, sheep will

usually get finer and shorter in the wool, especially as they get older, whether it be a good season or bad, unless they are specially fed. The object, however, is not to advocate the breeding of strong wool. The ideal wool to breed is one of about 2½ to 3 inches average staple, and to get this the farmer will have to aim at the medium. But on no account must quality be lost sight of. Although the buyer looks for fine wool with a good staple, he prefers a stronger wool with good quality to a fine wool without quality. A few breeders have probably overstepped the bounds of Merino wool by getting too strong a wool, but provided they have not lost quality, it is an easy matter to bring such sheep back; indeed, old age and bad seasons will do so as much as any breeding ingenuity. My advice to farmers, therefore, is: study your climatic conditions; if such you know for certain will tone down the strength of your wool and reduce its length considerably, then go in for strong-woolled rams with plenty of quality, so as to breed a good commercial wool. When farming in mixed-veld country with reliable seasons, where it is not difficult to keep up length of staple, the medium-woolled ram with good length should be aimed at in breeding a good commercial wool. The main object of the Merino sheep is the production of fine wool: South Africa is admirably suited for this, and if this is kept in view we can never lose our advantage over other countries that are to-day breeding mutton breeds and long wools and slowly but surely losing their place as fine-wool-producing countries.

The ideal commercial wool is a medium to fine wool, with good combing length and quality. As already stated, one must breed this in suitable areas by breeding for a medium wool with good length, and it will assuredly become finer with environment and old age. In other parts the farmer must go for the strong to medium wool, not forgetting length and quality, and the season will tone it down to medium to fine. The most objectionable wool a producer can put on the market is a strong, coarse, harsh, straight-fibred wool, which is usually a result of indiscriminate breeding for strong wool whilst neglecting quality and texture. The use of fine-woolled rams in studs is sometimes necessary for a specific purpose only, such as bringing back ewes that have exceeded in the strong direction. But in the case of stud ewes each individual ewe is carefully mated, which cannot be done in flocks. It must be clearly understood that reference to strong wool does not mean wool of 54's, 56's, or 58's, which is cross-bred, but a high-class 60's wool showing plenty of character and quality, which is favourably regarded by the trade.

Fifteen years ago when Mr. Chas. Mallinson preached the gospel of strong wool for the improvement of short, fine, lean-stapled flocks, he meant a high-class bulky 60's to 64's wool, and not " ull's wool " of 54's quality.

It is hardly fair to blame the experts in cases where the bounds of moderation have been exceeded regarding strong wool.

GOOD FLOCK RAMS BETTER THAN BAD STUDS.

The farmer must be very careful to keep his flock ewes of a flock type by avoiding the use of bad stud rams among them. The good selected flock ram worth about £10 to £15 is always a better ram for the flock than the £25 or £30 stud ram. Such a stud ram usually has the development of a real stud, such as heavy neck-folds and

wrinkles on the body, but invariably carries a short, dense wool rather fine in the fibre, or otherwise he lacks quality. This style of ram gives the flocks development: such sheep are usually bad doers, unless specially treated like studs, and at the same time the breeder departs from the desirable commercial wool. Many farmers ruin their flocks by the use of such rams, thinking that on account of the price they must be better than the £12. 10s. flock ram.

AGE OF RAMS WHEN SELECTING.

Sheepmen know the great difficulty of judging the value of a sheep when it is comparatively young. One never can tell accurately what the value of such a sheep is going to be. Some very fine twelve-months' old rams when changing their teeth become culls, whereas

Group of Tasmanian type Merinos. Note the similarity of type between these and the Peppin type.

others improve. Buying or selling young rams is a gamble and a bad policy from both the seller's and buyer's point of view. Rams should be at least two-teeth before being offered for sale. Even between the two-tooth and four-tooth stage they very often improve or go back.

DESIRABLE QUALITIES IN FLOCK RAMS.

The following are the most important features to look for when buying flock rams: :—

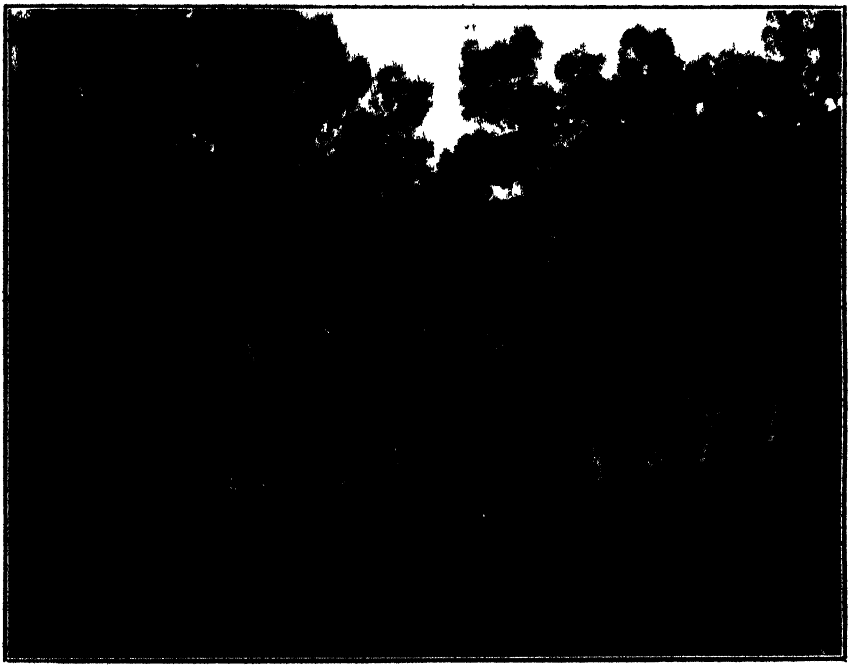
Frame.—Plain body, large frame, open face.

Wool.—Length and quality.

Buyers are apt to expect too much for an outlay of £10. Do not expect to buy a good stud ram for this sum. Provided the sheep has a large frame, with good legs and no physical faults, carries a good length of wool with any amount of quality, and has a good

sound back, the buyer must be prepared to sacrifice belly and points to a certain extent; of course, if he is particularly keen to improve the belly of his flock he would probably have to sacrifice the top-covering to some extent. But one generally finds that with a plain-bodied, long-woolled flock ram the belly and points are inclined to be weak. Remember again, you cannot buy a good stud ram far £10.

It is not advisable for any buyer of rams to buy a cheaper ram than a £5 one which would mean, in the majority of cases, procuring an uncut hamel, which will not improve the flock.



Group of Peppin Blood on Wanganella Rams Note the similarity between this type and the present day Tasmanian type

Yolk.—This is one of the most desirable qualities in wool. If good, it keeps the wool healthy and soft, giving it a bright, lustrous appearance and preventing it from becoming cotty or matty. When buying rams for a warm, dry climate, a buyer must be careful to get a good supply of clean, white, fluid yolk, otherwise his wool will get dry and harsh and mushy in the tips, letting in dust and rain and other weathering conditions. Rather err on the right side and buy rams showing a little too much yolk to your liking, in the form of a small black tip. They will probably lose most of this in a warm, dry climate, especially if their food is not very succulent and rich. On the other hand, a sheep bred in a warm climate will usually develop more yolk when brought to a cold climate. When buying for such a climate then it is only necessary for the rams to have a sufficient

supply of yolk to keep the wool healthy and free. In no circumstances buy rams with a thick, pasty, yellow yolk, because it is a very hard yolk to scour out: it also adds considerable waste weight and freight to your clip, and buyers object to it.

DISQUALIFICATIONS.

The following list of disqualifications in rams will be found useful by buyers:—

1. Undershot or overshot jaws (short or long bottom jaws).
2. Presence of black wool in the fleece.
3. Kemp (depending on the amount shown).
4. Unsound breeding organs (e.g. one testicle).
5. Very sandy coloured legs.
6. Rams without horns.
7. All four black hoofs.
8. Black streaks through both horns.
9. Devil's grip.
10. Cow-hocks or knock-knees.
11. Black eyelids or eyelashes (such rams may throw black or spotted lambs).

Of the above, numbers 1, 3, 5, 7, 10, and 11 will depend upon the extent to which these disqualifications appear.

THE CUCURBIT LADYBIRD BEETLE

(*Epilachna chrysomelina* F.).

By D. GUNN, Entomologist, Division of Entomology, Port Elizabeth.

DURING the summer months of 1922-1923, this leaf-eating ladybird became very prevalent in Sundays River Valley, and did considerable injury to cucurbit plants, cucumbers and water-melons suffering particularly. It has long been known in South Africa, but it is seldom a serious nuisance year after year in the same locality, and often a season in which it is very destructive may be followed by several in which little or no damage is done by it.

Studies were specially undertaken with a view to elucidating the life-history of the insect and towards devising suitable measures for its control.

This insect is one of the few ladybirds that injure plants, the normal food of the members of this family being aphides and scale insects.

NATURE OF INJURY.

Both larvae and adults feed on the leaf tissue, eating away all until only a skeleton of veins and nervures is left. The beetles, when very numerous, may do considerable mischief, but, on the whole, most damage is done by the larvae. Young plants when badly attacked may soon wither and die.

The larvae and adults have frequently been found feeding on various native plants of the melon group, both on the veld and in proximity to cultivated plants. Among the cultivated plants, cucumber, water-melon, and pumpkin appear to be the favourites.

LIFE-HISTORY AND HABITS.

The egg is about one-sixteenth of an inch or 1·50 mm. long. It is pale yellow in colour with the surface of shell very finely pitted. In outline the egg is elliptical, and is attached to the plant by the broader basal end, which is glued on to the fine pubescence of the leaves. Eggs are deposited in clusters of eight to over forty. When the eggs hatch, the young larvae escape from the top or narrow end.

With a view towards ascertaining the number of eggs deposited by a female, pairs taken *in coitu* were kept under observation. With these, egg-laying extended over a month, and it was found that one may deposit from 150 to 189 eggs.

The period of incubation was found to range from nine to eleven days.

The larva when it emerges from the egg is yellow and has short spines of the same colour, but within a few hours these spines become dark brown. It is elongate-oval in form and about a twelfth of an inch, or 2 mm. in length. During the first day after emergence it

remains on the egg-shells, and afterwards begins to feed upon the tissue of leaves. There are two rows of long branched spines on each side and two on the dorsum or back, which are darker at the tips. When full grown the larva is slightly over a fifth of an inch or 5 mm. in length; the formidable branched spines are prominent and arranged both transversely and longitudinally. In the early stages the larvae are inconspicuous, and, as they feed slowly, the initial damage is not apparent. After emergence they are gregarious in their habits, and the larvae from several clusters of eggs have been observed to form one large colony, but this gregarious instinct is not so apparent after the first moult.

Larvae moult four times. The first moult occurs within from five to seven days, the second within from four to six, the third

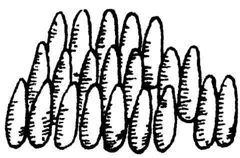


FIG. 1.
Eggs (enlarged).

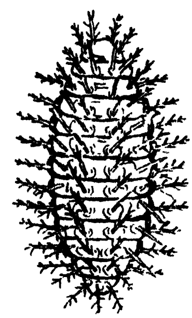


FIG. 2.
Larva (enlarged).

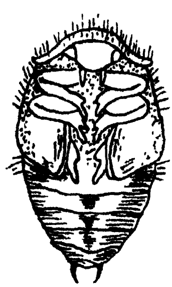


FIG. 3.
Pupa (enlarged).

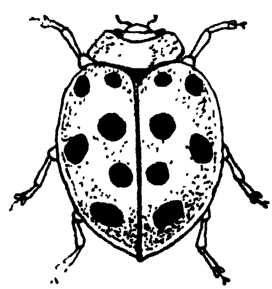


FIG. 4.
Adult (enlarged).

within five days, and the fourth occurs before pupation. After each moult the spines become darker and larger, and at a casual glance appear to cover the whole of the dorsum or upper part of the body. Feeding is very largely restricted to the lower surfaces of the leaves, and the habit of remaining in one place until the food supply has been exhausted seems characteristic.

In the insectary, a number of mature larvae developed cannibalistic habits, even in the presence of a liberal supply of food, larvae which had pupated being the victims.

The larval stage lasts from twenty-five to thirty-seven days, and its length depends principally upon the prevailing temperature and

the supply of food available. When mature, the larva crawls to a sheltered position out of the way of the direct sunlight, and attaches itself by the posterior end of its body to a leaf or twig. In from seven to nine days the outer skin or integument containing the long dark spines shrivels and splits, and the adult emerges. The pupa is ovate in outline and about the same size as the adult.

The adult beetle is oval in outline, and has an average length of a third of an inch, or 8 mm. The ground colour of the wing covers or elytra is buff, and there are six black spots on each. When it emerges it is yellow, but within eight hours the normal colours, including the spots, appear on the wing covers. The beetles are slow in their movements and are not strong fliers. When the weather becomes cold in May or later, they hibernate under rubbish left in fields and gardens, stones, bark of eucalyptus and other trees, and remain there until the weather becomes warm in spring or early part of summer. The time when the beetles emerge from their hibernating quarters depends principally upon the climatic conditions. If the weather is cold, egg-laying may be delayed until the end of November.

A number of beetles was collected in Sundays River Valley towards the end of March, 1923, and placed in a cage in the insectary. Although food was supplied at intervals during the winter months, it was rarely eaten. The last of the beetles survived until November, 1923, having lived for over eight months in captivity.

NUMBER OF GENERATIONS.

To ascertain the number of generations in a year, beetles of both sexes were collected in Sundays River Valley during the winter months of 1923 and kept under observation in the insectary. They remained in hibernation until the middle of October, and eggs were not deposited until the last day of that month.

Generations of Epilachna chrysomelina *F.*, *Port Elizabeth*, 1923-24.

Generation.	Eggs Deposited.	Eggs Hatched.	Length of Egg Stage.	Larvae Pupated.	Length of Larval Stage.	Adults Emerged.	Length of Pupa Stage.	Total Developmental Period.
First	1923 Oct. 31	1923 Nov. 9	10 days	1923 Dec. 6	27 days	1923 Dec. 13	7 days	44 days
Second	Dec. 18	Dec. 29	11 days	1924 Jan. 23	25 days	1924 Jan. 29	6 days	42 days

Generations of Epilachna chrysomelina *F.*, *Port Elizabeth*, 1924-25.

Generation.	Eggs Deposited.	Eggs Hatched.	Length of Egg Stage.	Larvae Pupated.	Length of Larval Stage.	Adults Emerged.	Length of Pupa Stage.	Total Developmental Period.
First	1924 Nov. 5	1924 Nov. 15	10 days	1924 Dec. 11	26 days	1924 Dec. 17	6 days	42 days
Second	Dec. 29	1925 Jan. 7	9 days	1925 Feb. 3	27 days	1925 Feb. 10	7 days	43 days

NATURAL ENEMIES.

During the two years in which this investigation was being conducted, no parasites emerged from the eggs, larvae, pupae, or adults in the insectary cages. The Cape Wagtail (*Motacilla capensis*) was the only native bird which was observed feeding on the larvae.

CONTROL MEASURES.

Fortunately it was found that the insect in both the larval and adult stages was comparatively easy to control, principally due to their sluggish habits and the tendency to remain on plants until the leaves had been almost entirely skeletonized. The methods which are recommended are as follows:—

Spraying with Arsenicals.—This method was found to be the most effective, and the formula recommended is: Arsenate of lead powder 1¼ lb., water 40 gallons; or paris green 1 lb., lime 2 lb., water 100 gallons. It is most essential that both surfaces of leaves should be thoroughly sprayed, as the larvae almost invariably feed upon the lower and the adults upon the upper surface. On account of the pubescent nature of the foliage of cucurbit plants, it is unnecessary to use an adhesive substance in the spraying solution. When spraying a small plot in a garden or field, arsenate of lead powder is usually used, but when a large field has to be treated, and when economy is an important consideration, paris green is a cheaper insecticide.

Experimental Work with Dusting.—Spraying the infested plants proved to be more satisfactory than dusting them with paris green and lime. This was principally due to the recumbent nature of cucurbit plants and also to the fact that the larvae frequent the under sides of leaves. In the absence of a suitable dusting machine, the small sulphur bellows used in this work was not effective. Another disadvantage is windy weather, which is so prevalent in the coastal districts during the summer months, and the dust is liable to be blown off plants.

Cultural Methods.—As the adults usually hibernate in large numbers under heaps of rubbish and old plants left in gardens and fields after the crop has been harvested, it is essential that this material should be collected and either buried in the soil, where it would act as humus, or burned. Native cucurbit plants growing in the vicinity of cultivated plants should be destroyed, as they provide food and shelter for the insect.

Early Planting.—As the beetles do not usually emerge from their hibernating quarters until towards the end of October or early in November when the weather is warm, it is recommended that, if possible, planting should be done before the beetles become active, so that the young plants are not injured excessively. By following this method the damage to the large plants may be negligible or at any rate readily controlled by spraying.

Collecting by Hand.—As the adults hibernate at the end of summer under rubbish and old cucurbit plants which may be left in a garden or field, they should be collected and destroyed by either crushing or placing them in a receptacle containing a small quantity

of paraffin and water. If this is done systematically by farmers each winter the infestation during the following summer should be reduced to a considerable extent.

When to Spray.—It is impossible to state definitely when the adults emerge from their winter quarters and begin to deposit eggs, as it is more or less determined by the prevailing climatic conditions. It is, however, comparatively easy to observe if plants are infested, as the leaves become yellow and are skeletonized by the larvae. Spraying should be begun before the young plants are injured, and if done thoroughly it may be unnecessary to spray them a second time.

SUMMARY.

(1) The cucurbit beetle is an insect which is distributed throughout the Union of South Africa.

(2) It feeds upon both native and cultivated cucurbit plants.

(3) The eggs are deposited upon the under side of the leaves of cucurbit plants, and when the larvae emerge they feed upon the tissue until the leaves are almost skeletonized.

(4) There are two generations in a year, and during the winter months the adults hibernate under rubbish and decayed plants which have been left in gardens and fields.

(5) Spraying should be begun whenever the plants are observed to be infested, and if done thoroughly it may be unnecessary to spray a second time.

(6) Cultural methods such as the burial of decayed plants under which beetles hibernate will greatly assist in reducing the infestation during the following summer.

(7) Planting in September or early in October before the beetles emerge from their hibernating quarters is strongly recommended.

DISEASES OF VIRGINIAN TOBACCO IN SOUTH AFRICA.

By E. S. MOORE, Ph.D., D.I.C., Mycologist in Charge of Tobacco and Cotton Diseases.

INTRODUCTORY.

THE tobacco plant, like every other product of long and intensive cultivation, falls a ready victim to many diseases. Those very factors which make for high quality in the harvested crop render the plant at the same time more liable to the attack of its enemies. Not only the decreased amount of yield, but to a far more serious extent the depreciation in quality, together effect enormous annual losses.

The satisfactory control of the diseases of even this single crop is a many-sided problem which still requires years of further investigation. Great advances have been made during the present century, and still there are countless points where our information is of the scantiest or is lacking altogether. Many of the statements presented in the following pages are based on records and investigations made in other countries, especially in the United States. Experience has shown that in the main they hold true for South African tobacco also, although often they require to be confirmed and amplified, with special reference to local varieties and conditions. They will serve, however, as a safe guide to the grower who realizes not only that he cannot afford to ignore disease in his crop, but further that it is to his own profit to make himself acquainted with its nature and cause.

SOIL-BORNE DISEASES.

DAMPING-OFF IN SEED-BEDS.

Damping-off is caused by the attack of several soil-dwelling fungi (species of *Pythium*, *Rhizoctonia*, *Fusarium*, and *Phoma*) which thrive under the moist shaded conditions of the seed-bed. They attack the stems of the seedlings, causing them to rot and collapse, and producing spores upon them. The disease often appears first in hollows where the soil remains wet, and will spread rapidly with excessive watering and bad ventilation. It attacks other seedlings also, and old garden soils known to be infected with it should be avoided when selecting a seed-bed.

Control Measures.—Choose a well-drained site for the seed-bed and sterilize by burning. Sow thinly. Avoid over-watering and give ample ventilation.

TOBACCO WILT.

Tobacco wilt is a troublesome disease which for many years has been known to occur in the United States and to cause losses in hot

seasons It has been reported at intervals from different districts in South Africa and has been specially prevalent during the 1925-26 season It appears to be old-established in the Kat River Valley, where it caused much damage as long as twenty years ago and where it persists as a serious handicap to the industry. The symptoms of the disease in the latter area are somewhat peculiar, but there is no

FIG. 1.—Wilted Plant split to show discoloured wood.
[*Photo by H. King.*

doubt that they are produced by a parasite closely resembling, and probably identical with, that which is responsible for the American wilt.

The disease is caused by a thread-like fungus (*Fusarium oxysporum* var. *nicotianae*) which lives in the soil and invades the rootlets of the tobacco plants. Its threads penetrate into the water-carrying

FIG. 2.—Tobacco Wilt.

FIG. 3.—Tobacco Wilt: One-sided development.

channels and grow along them into the main root and stem. If the bark be stripped away near the ground, a dark discoloration of the outer wood will usually be plainly seen, and may often be traced from its origin in the root upwards into the growing shoot and midribs (see Fig. 1). It is due to the presence of the fungus, which both blocks and poisons the water supply and hence produces wilt symptoms in the leaves. The effect upon the leaves varies considerably and appears to depend upon the nature and vigour of the attack in the root. If the whole of the water-supply of a well-grown plant is blocked, all the leaves droop, turn yellow (without spotting), and die within a few days (Fig. 2). Plants may be attacked in this way at any time from transplanting until harvesting. Often, however, only one lateral root may be invaded and the leaves on that side of the plant are alone affected, the other side remaining normal and healthy. The leaves up the affected side are dwarfed, yellow, and spotted, and the growing shoot is frequently bent over, giving rise to the name of "kromnek siekte" (see Figs. 3 and 4). Both types of disease occur in the Kat River Valley, in addition to a third type which appears to be peculiar to that area (Fig 5). This third type appears even in the seed-bed, and it is probable that the rootlets become infected either then or at transplanting, so that the plants never make any normal growth. They may be still living at the end of the season, but are stunted in development and produce only small crumpled, misshapen, and spotted leaves clustered into a rosette (see Fig. 6). Such plants are utterly useless and often occur, especially with early plantings, in such frequency as to necessitate the ploughing under and replanting of the whole field. The main root is stout, but a normal growth of healthy laterals is conspicuously lacking.

The fungus is disseminated by spores which have been found in abundance on old stems and stumps. On these, and also probably in the soil, it can survive for perhaps several years. The disease can also be disseminated in soil moved accidentally from infected fields or by water draining off them. The parasite thrives best at high temperatures, and in both America and South Africa it has been found more prevalent in hot dry summers. Any injury to the root facilitates its entry and wilt is likely to be more severe on land infested with nematode.

There is evidence that not all varieties of tobacco are equally liable to attack. American experience has shown a marked difference in susceptibility, and in the western Transvaal it was noticed that "Joiner" was much more resistent than "Sterling" or "Groot Swazie." This might not hold good for all districts, but suggests a hopeful line for future control of the disease.

Tobacco wilt is not known with certainty to attack other plants (except *Nicotiana* species), but the matter is one that requires fuller investigation, and in the meantime all solanaceous crops—such as potato, chili, and tomato—should be regarded with suspicion when a rotation is being selected.

Control Measures.—Since wilt is a disease which has already shown itself capable of causing heavy losses, no farmer can afford to disregard it, especially since, like other soil-dwelling parasites, it is very difficult to eradicate when once firmly established. The following precautions are suggested for wilt-infested lands:—

(1) Pull up and burn diseased stumps whenever possible.

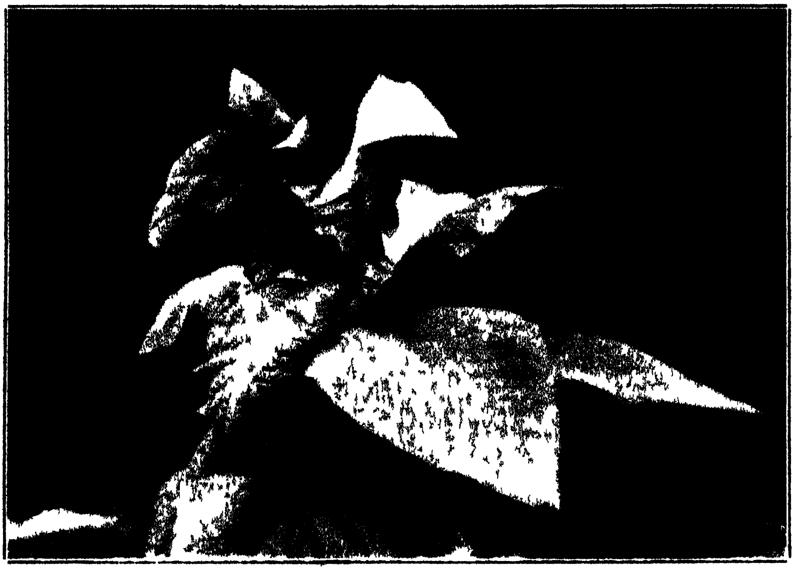


FIG. 4.—An early stage of Tobacco Wilt ("Kromnek").

FIG. 5.—Tobacco Wilt (two types) in Kat River Valley.

(2) Choose new ground for the seed-bed and burn it thoroughly.
(3) Practise a long rotation, selecting one which reduces nematode. Avoid other solanaceous crops.
(4) Watch for disease-resistant plants and test them on infested soils.

FIG. 6.—Tobacco Wilt (stunted type of growth).
[*Photo by H. King.*

LEAF DISEASES.

WILDFIRE.

Wildfire is the most dreaded of the diseases which afflict tobacco, and on account of the rapidity of its spread and the heavy losses it may cause it is one that the grower has every reason to fear. It was first noticed in the United States in 1917, and has now been reported from most of the tobacco-producing areas of the world. South African growers of both Turkish and Virginian tobacco have already suffered heavily from its depredations in seasons favourable to its spread.

Wildfire may attack the plant at almost any stage of growth. In the youngest seedlings light yellow-green patches appear at the tip or edge of the leaf, and are followed by a progressive rotting resembling damping-off (see Fig. 7). On older plants the typical symptom is a leaf-spot with a broad yellow-green band (the halo) surrounding a dried centre. The halo is the distinctive feature of

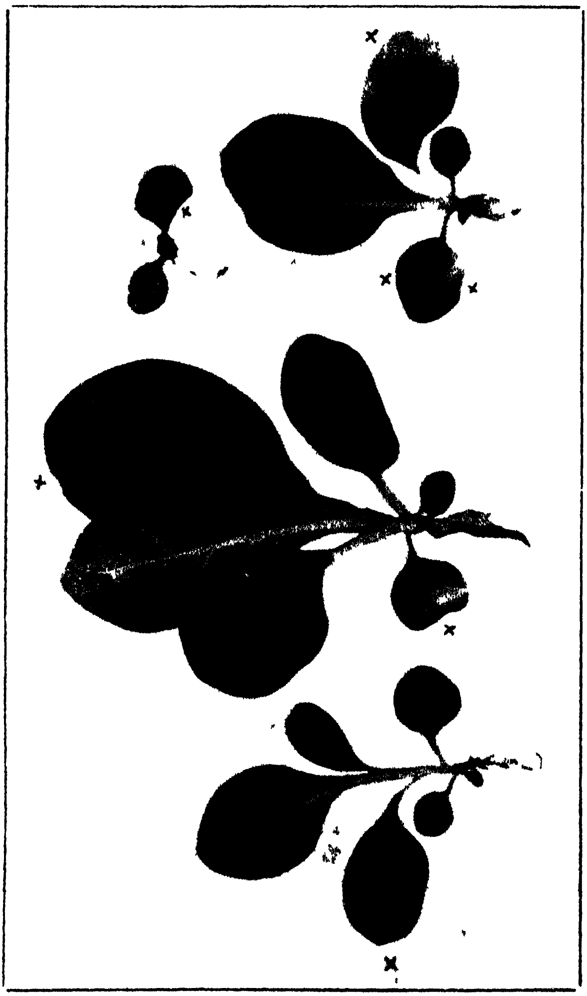


FIG. 7.—Wildfire in Seedlings (infected leaves marked).
[*Photo by H. King.*

the wildfire leaf-spot, and is almost always evident, especially in new infections. As the disease establishes itself, the dried brown centre enlarges and becomes brittle; the spots run together and render the leaf worthless (Fig. 8). Usually the lower leaves are the first to be attacked, but under favourable conditions the disease may spread rapidly to the top of the plant.

Wildfire is caused by a very small bacterial parasite (*Bact. tabaci*) which invades the leaf and lives and multiplies within it. The

organism, in spite of its minute size, has been isolated and examined miscroscopically, and by inoculation into healthy plants it has produced typical wildfire symptoms (Fig. 9). Like most bacteria, it thrives best under warm moist conditions. The bacteria ooze out from the spots on infected leaves and are readily carried in water-drops from one plant to another. Wind-blown rain will rapidly spread infection through a field, and the hands, clothes, tools, etc., of workers may also carry away disease-germs from infected plants. Any injury to the leaf will assist the entry of the bacteria, and it has

FIG. 8.—Mature Leaf heavily infected with Wildfire.

[*Photo by H. King.*

been found that hailstones and biting insects (especially in the seed-bed) play an important part in epidemics of the disease (Fig. 10). It is quite possible for wildfire to survive, scarcely noticed, in spots on the lower leaves during weeks of dry weather, and then to spring into activity through the whole field after a spell of cloudy days and storms.

There is no definite evidence that susceptibility to wildfire is influenced in any way by fertilizers. It seems to be less prevalent on sandy soils.

In spite of close search around infected seed-beds and fields, no plants except tobacco have ever yet been found attacked by wildfire. Many suspected leaf-spots both on weeds (especially Cape Gooseberry and Stinkblaar) and on crop plants have been submitted for examination, but in no case was the wildfire organism responsible for the spotting. *N. rustica* also is not attacked under field conditions.

There are many possible ways in which wildfire can survive the winter and spread from one district to another.

(1) *In diseased leaf* the bacteria can live through frost and long periods of drying, and dead diseased plants left standing in the field

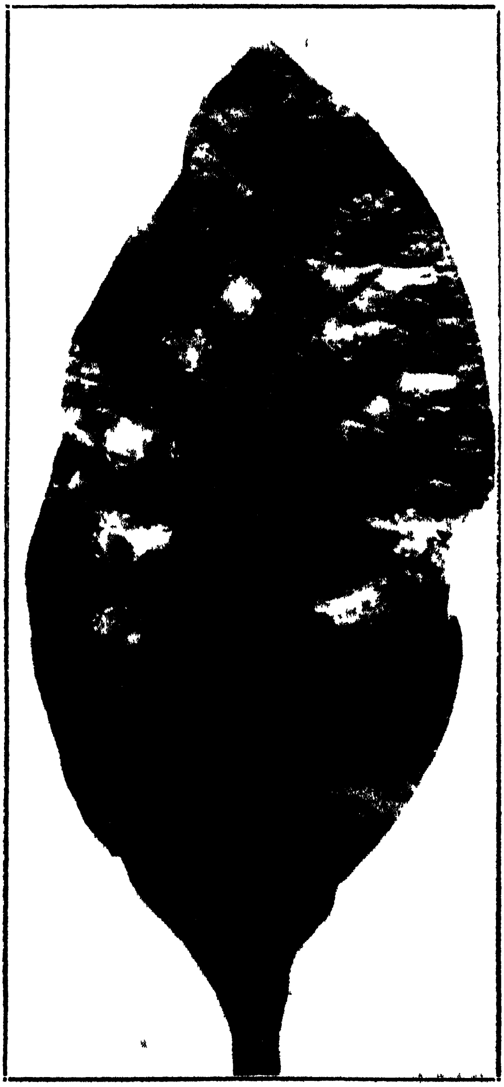


FIG. 9.—Leaf artificially inoculated with Wildfire.

[*Photo by H. King.*

are still infective in the following spring. The autumn suckers from stumps after harvesting are often heavily infected (Fig. 11), and may well carry the disease through the few months elapsing before the next seed-bed season. It has been found that diseased leaves

FIG. 10.—Heavy infection of Wildfire following on hail injury. [*Photo by H. King.*

stored dry in barn or warehouse remain infective for over a year and produce the typical wildfire symptoms if placed in contact with growing plants. The high temperatures of the warehouse curing are sufficient, however, to destroy the germs in the fully cured Virginian leaf, whilst leaves ploughed into the soil lose their infectivity as they decay.

(2) *In soil.* Laboratory studies have shown that under certain conditions the bacteria may live in both soil and water for some time. The soil of a field where a diseased crop has grown is infected both by leaf drippings and by diseased leaf-fragments. Just how long either kind of infection remains active probably depends on conditions of climate, moisture, etc., and it is possible that dry winter

FIG. 11.—Autumn Sucker infected with Wildfire.

[*Photo by H. King.*

conditions, in preventing the decay of scattered leaves, may prolong the infectivity of the soil.

(3) *On seed.* It has not been definitely proved that seed saved from an infected crop will inevitably produce infection in the subsequent seed-beds. It is obvious, however, that such seed, or even healthy seed, may unavoidably become contaminated by minute fragments of diseased leaf, which, owing to the rough corrugated seed-coat, will be difficult to dislodge and may readily transmit disease.

Control Measures.—In many cases the outbreak of wildfire in the field can be with certainty traced back to infection in the seed-bed. It may be that this is *always* so, since primary infection is less likely to occur in the open field than in the damp crowded seed-bed. It is, however, impossible to prove the point, since a small seed-bed infection may easily be overlooked; and, further, a field crop may be infected from neighbouring seed-beds or fields. Actually, a clean seed-bed does not seem to *guarantee* a healthy crop in tobacco-growing areas where the necessary precautions are not universally adopted. Conversely, cases have been noticed where infected seedlings have yielded a clean field. Sometimes, moreover, even when wildfire has appeared after transplanting, a spell of dry weather will enable the crop to grow away from the disease.

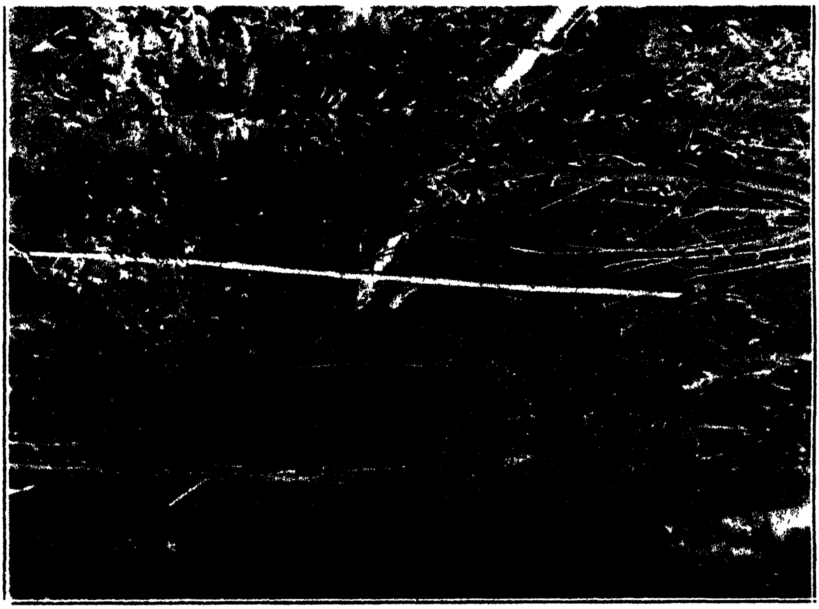


FIG. 12.—Seed-beds protected by branches: An unsatisfactory method. [*Photo by H. King.*

The fact remains, however, that much may be done by thorough control of the disease in the seed-bed, and if this aspect were given its rightful attention by *every grower*, wildfire would be driven from its present position of menace. Moreover, according to our experience up to the present, it is only amongst seedlings that effective control measures can be undertaken without either great labour or great expense, and there is therefore every reason to insist upon the importance of *controlling wildfire in the seed-bed.*

Full information regarding the preparation of seed-beds will be found in Reprints No. 1 (Tobacco Seed-beds) and No. 69 (Local Series, Turkish Tobacco Seed-beds), obtainable from the Librarian, Department of Agriculture, Pretoria. The following points require particular attention regarding the prevention of wildfire:—

Selection of Site.—Choose fresh ground, or, at any rate, ground that has not recently borne tobacco. It should be well away from

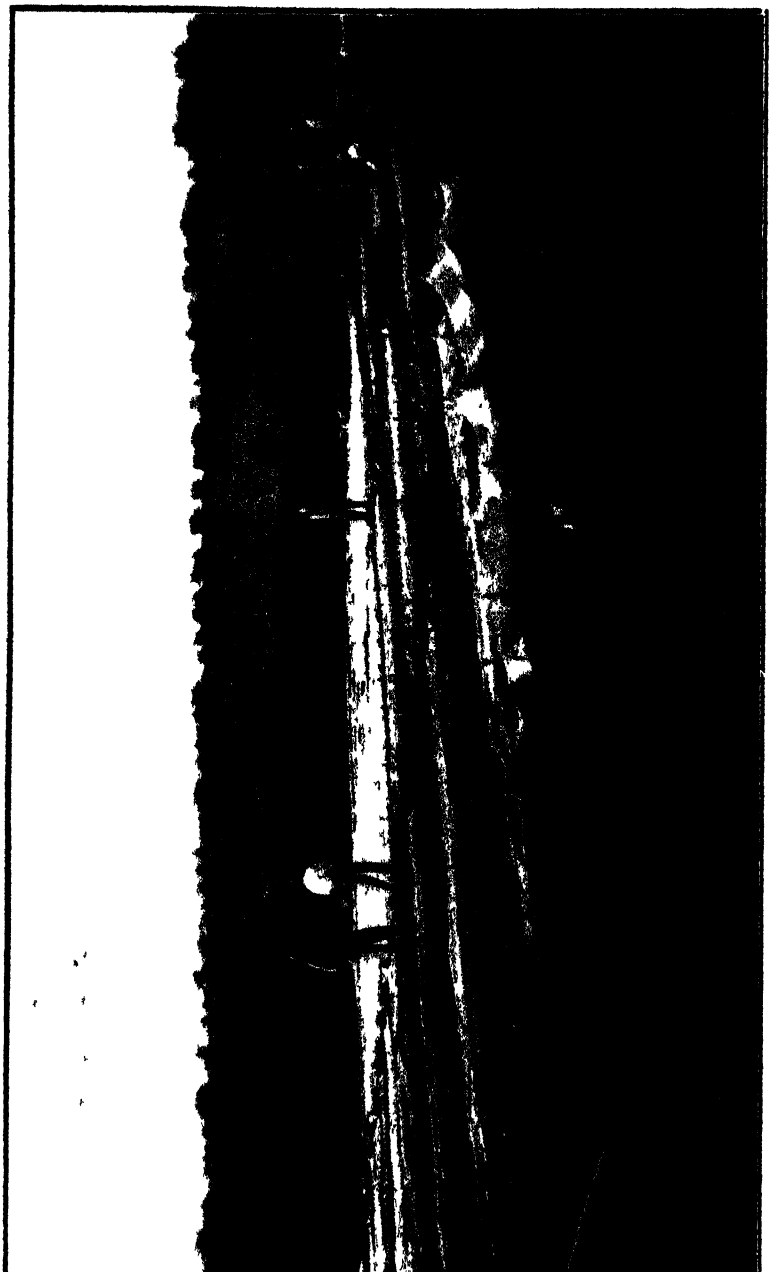


FIG. 13.—Seed-bed protected by Cheesecloth Covers

curing-sheds and should not receive drainage-water from old tobacco fields. It is particularly important that no tobacco refuse should in any way gain access to the seed-bed.

Preparation.—It is strongly advised that the ground be sterilized by thorough burning, which not only destroys disease germs, but also kills insects and weed-seeds. Probably, also, the wood-ashes help the seedlings to resist disease. The cultivation and manuring of the bed should be completed before burning, and every opportunity for subsequent reinfection must be guarded against.

Seed.—As stated above, even healthy seed may easily become contaminated by infected dust, chaff, etc., and all seed should be disinfected before sowing according to the following procedure:—

FIG. 14.—Angular Leaf Spot.

[*Photo by H. King.*

DISINFECTION OF TOBACCO SEED WITH FORMALIN.

Obtain a small quantity of "*Commercial* 40 *per cent. Formalin*" from any reliable chemist. The cost is about 3d. per oz., and 1 oz. will be sufficient to treat 4 oz. of seed. Add one part of formalin to sixteen parts of water.

Put the seed into a loose muslin bag, dip into water for a minute until thoroughly wet, drain off, and then soak in the weak formalin for exactly fifteen minutes with frequent shaking and stirring. Then wash *thoroughly* with at least four or five changes of plenty of clean water, and spread out upon clean paper to dry. When quite dry, put the seed back into the dried bag and store it in a place where it cannot become contaminated by old tobacco leaf, etc. Avoid handling too large a quantity of seed at a time. If thoroughly washed, treated seed should remain good for at least three months.

Many growers favour very early sowing in order to produce firm hardy plants. They must remember, however, to off-set against this, the *drawbacks* of a much longer period of exposure to infection, during the whole of which no precautionary measure can safely be relaxed. Overcrowding in seed-beds will favour wildfire, and thin sowing (1 oz. seed to 100 square yards of seed-bed) should be practised.

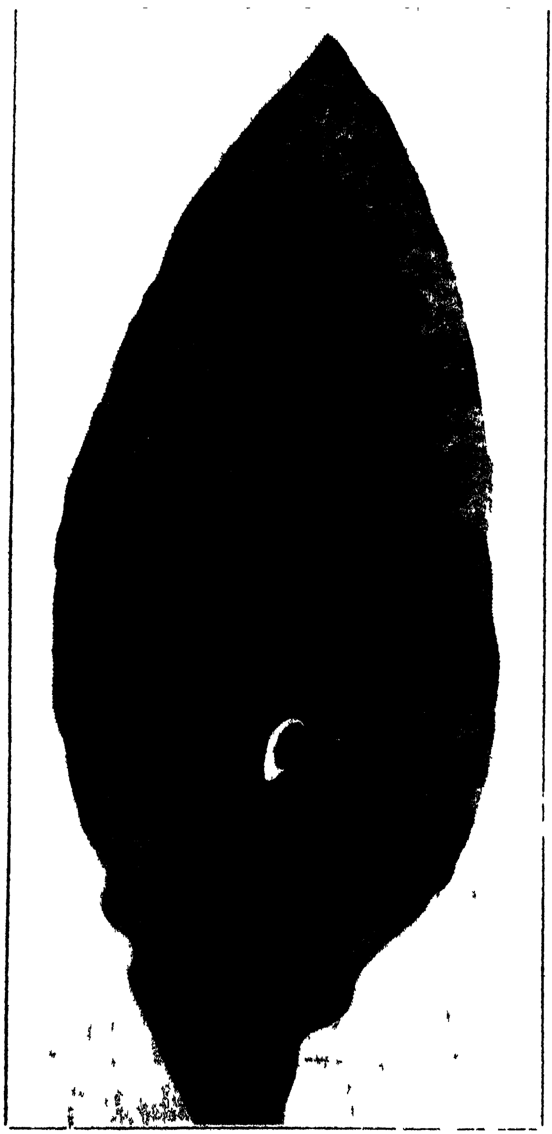


FIG. 15.—White Rust or Mildew.
[*Photo by H. King.*

FIG. 16. [Photo by H. King.

Covering.—Grass and branches are often used to protect the seed-beds. Cheese cloth or hessian are, however much more satisfactory, since they enable better control of the ventilation (Figs. 12 and 13). Unless new, the covers should be sterilized by boiling.

Care of Beds.—The grower must be constantly on the watch both to prevent the conditions favourable to the development of wildfire and to detect its first signs should it appear Watering must not be excessive and ventilation should be so arranged as to allow the leaves to dry off rapidly If infection appears in an isolated patch it is

FIG 17 —White Speck

[*Photo by H King*

best either to dig out the group of plants or else to destroy them on on the spot by drenching with formalin (1 part to 15 parts of water), the bed being freely ventilated afterwards. Infection may be spread by the workers' hands or tools during weeding, etc., and beds should therefore be handled only when the leaves are dry.

The most important preventive measure is the regular and thorough *spraying* of the seed-bed with a fungicide. This should be carried out as a routine process without waiting for wildfire to appear. It should be started when the seedlings are no bigger than a sixpence, and should be continued until transplanting. One application a week

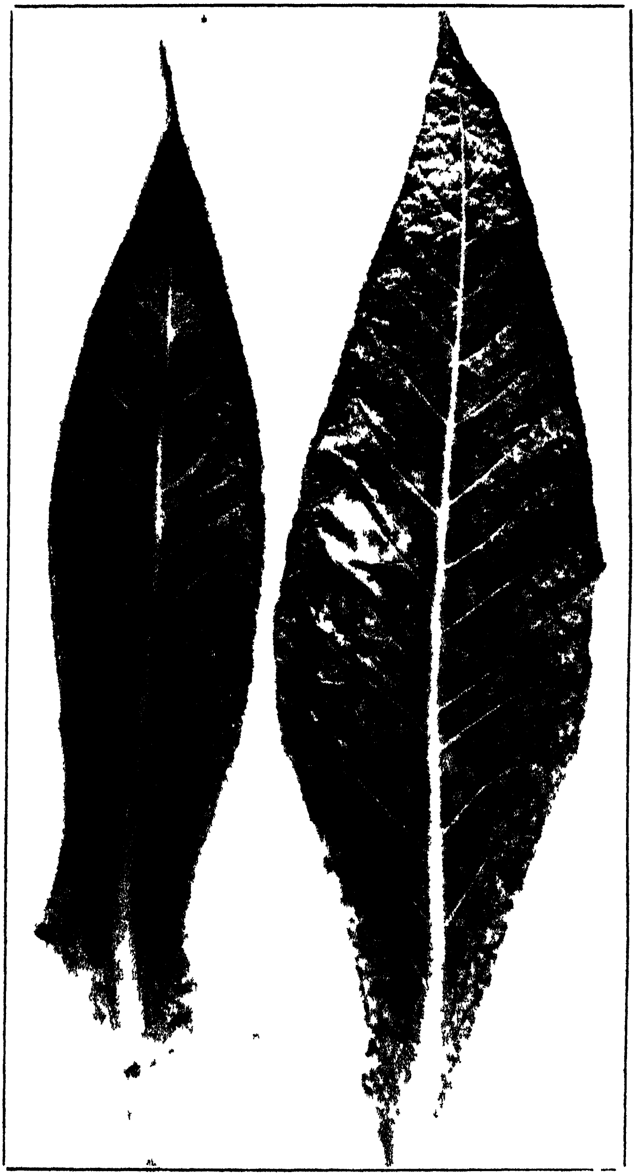


FIG. 18.—MOSAIC.

[*Photo by H. King*

is generally sufficient to keep the leaves covered with fungicide, but frequent rains or heavy watering may make a shorter interval necessary.

Bordeaux at 4-4-50 strength has been found effectively to protect seed-beds from infection without causing any injury to the plants. The addition of lead arsenate (3 oz. powder to 4 gallons spray) is

FIG. 19.—Leaf Spot of unknown cause.

[*Photo by H. King.*

advised in order to keep down biting insects, whilst a prepared "spreader" may with advantage be added to ensure that the leaves are thoroughly wetted. Either a home-made bordeaux mixture may be used, or one of the proprietary compounds prepared by a reliable South African manufacturer. The home-made is the cheapest, but the others are more convenient to use and are of guaranteed quality.

FIG. 20.

[*Photo by H. King.*

HOW TO MAKE THE BORDEAUX SPRAY.

For *home-made mixture*: Obtain copper sulphate (bluestone) and fresh quicklime of good quality and prepare the two *stock solutions* as follows: Pour 25 gallons of water into a barrel or earthenware vessel (not metal). Weigh out 25 lb. of bluestone, tie it into a sack, and hang it in the water to dissolve completely. Put 25 lb. of quicklime into another vessel and slake it by adding water gradually; finally add water enough to bring the amount up to 25 gallons. These two stock solutions are each now at the strength of 1 lb. to the gallon, and will keep for some time. To make up the spray as required for use, put 4 gallons of the stock bluestone solution into a barrel, and add 21 gallons of water. Stir up the stock milk of lime, measure out 4 gallons into

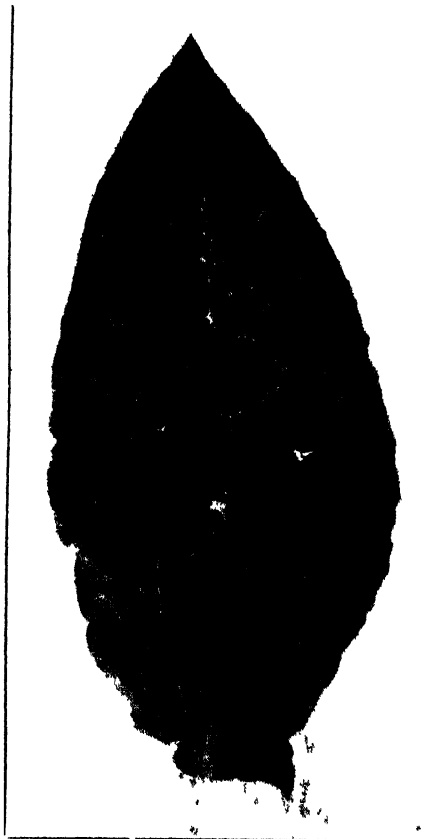


FIG. 21.

[*Photo by H. King.*

another barrel, and add 21 gallons of water to it. These two weak solutions must now be slowly poured together, at the same time, into a large barrel. Add the "spreader" and the lead arsenate as directed, and the spray is ready to use. It should be kept well stirred, and should be sprayed on to the plants as soon as possible. A more adhesive spray is obtained if a good-sized leaf of prickly-pear be chopped into pieces and soaked overnight in 50 gallons of water; strain off next day and use the liquid, instead of water alone for the dilution of the stock solutions.

For *dry bordeaux powder*, use 5 to 6 oz. to 4 gallons of water, and mix thoroughly. For other mixtures, use as directed to give a spray equivalent to 4-4-50 strength.

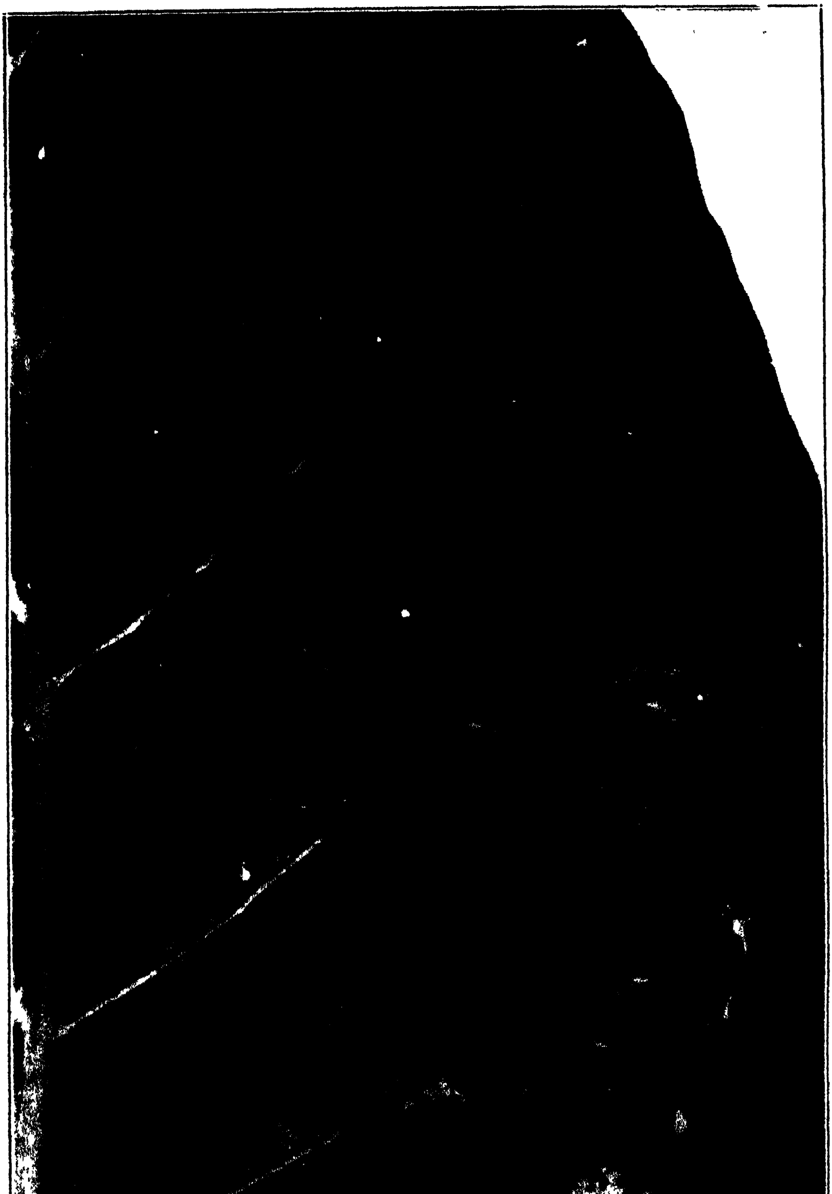


FIG. 22.—Red Rust.

[*Photo by H. King.*

Other spray mixtures are in frequent use amongst growers, but it cannot be too strongly urged that bordeaux is the most effective and the safest to use against wildfire. It may be added that the outlay for the purchase of a simple but satisfactory spray-pump is soon reimbursed through the saving in materials.

Bordeaux dusts have been tested on a small scale, but at present seem hardly to offer any advantage over the old-established spraying treatment.

Transplanting.—There is grave risk in using diseased seed-beds for transplanting, although it is hardly necessary to reject those in which only isolated plants have been affected and in which the disease has been kept in check by regular spraying. It is useful, as the plants are lifted, to dip their heads in the bordeaux spray-mixture in order to reduce the risk of spreading infection by handling.

Precautions in the field are of very doubtful value. The removal and destruction of infected leaves and plants may be useful in the first few weeks after transplanting, but, on the whole, once his crop is established in the field the grower is at the mercy of weather conditions as regards the spread of wildfire. Under the normal dry summer conditions of the south-west Cape Province, combined with the special methods of harvesting, wildfire is hardly *likely* to become a constantly serious danger to growers of Turkish tobacco, apart from the damage it may do in the seed-bed. In areas of summer rainfall, a spell of wet weather late in the season may ruin the crop, whilst dry weather may enable younger plants, even though diseased, to mature in health and give a good return. The influence of the weather has been plainly illustrated during the 1924-26 seasons. In the earlier season wildfire was widespread and rampant, whilst in the abnormal drought of the second summer it was in many fields difficult to discover a single spot of the disease.

The protection of the succeeding crop must be considered as soon as harvesting is over. All field refuse should be ploughed in as early as possible in order that by thorough decay it may cease to be infective. It must be remembered also that all barn refuse is dangerous, and since the barn is usually near the farm buildings diseased material may easily be carried back into the field by workers, tools, animals, or wind. Much greater attention should be paid to the destruction of all tobacco waste as long as possible before the seed-beds of the next season are prepared.

ANGULAR LEAF-SPOT.

Angular leaf-spot is caused by a bacterial parasite (*Bact. angulatum*) which lives and spreads in much the same way as wildfire, but differs in the appearance of the leaf-spots it produces (Fig. 14). These are small, ranging from pin-head size up to ¼ inch in diameter, and their most striking feature is their irregular angular shape and jagged outline. They are dark brown and faintly zoned at the beginning, but bleach later. If the leaf is held against the light a narrow light band may be seen bordering the spots, but this cannot possibly be confused with the broad yellowish "halo" so characteristic of wildfire. The spots tend to run together as they get older and the dried patches crumble or break. The disease appears both in the seed-bed and in the field, and is favoured by wet cloudy weather. Under such conditions it may cause serious losses.

Fig. 23.

[Photo by H King.

Since the bacteria causing wildfire and angular leaf-spot are very similar in their way of living and in their method of attack upon the tobacco plant, the same preventive measures should be used against both diseases.

WHITE RUST (OR MILDEW).

White rust is a very common leaf-disease which markedly depreciates both weight and quality. It is caused by a fungus (*Oidium*) which creeps over the outside of the leaf, giving it a greyish-white appearance, sometimes in patches and sometimes covering the whole surface (Fig. 15). Powdery white spores are produced in abundance, and rapidly spread the disease if the conditions are favourable. The fungus thrives best in a moist atmosphere and develops usually on the lower shaded leaves, especially when the plants are large and crowded. Damp weather or excessive irrigation will encourage the spread of the disease through a maturing crop.

Control Measures.—Control of mildew is very difficult, and the best that can be done at present is to avoid the conditions which favour its growth. When planting, allow full spacing both in and between the rows to ensure ample ventilation. If the mildew is spreading rapidly amongst crowded ripening plants it may be profitable in some cases to check it by harvesting the lower leaves separately so that air can pass freely below.

RED RUST.

Red rust (Fig. 16) is a common leaf-spot caused by the attack of a fungus, *Macrosporium longipes*. The spots are not unlike those of wildfire, but are distinguished in being more rusty, thicker, and rougher in texture, and more strongly ridged. The yellow-green halo characteristic of wildfire in its early stages does not appear in red rust, which, however, may cause premature yellowing of the leaves towards the end of the season. Red rust is never likely to be so dangerous a disease as is wildfire, and it is important to be able to recognize the two types of spot. No practicable control measures can be suggested.

WHITE SPECK.

White speck is a little-understood spotting which develops on the lower and middle leaves, especially on plants affected by mosaic (Fig. 17). The pale brown spots are scattered and separate at first, and then run together to form bleached scorch-like patches between the larger veins. The fungus *Macrosporium tabacinum* can usually be found in them. No practicable control measures have been devised.

MOSAIC.

Mosaic is a disease that occurs wherever tobacco is cultivated. The plants grow to normal size, but the leaves are mottled over the whole surface with patches of dark and light green (Fig. 18) and are of inferior quality when cured.* No visible parasite has ever been

* This must not be confused with an occasional abnormality which is similar to the *variegation* of many ornamental plants, and in which the growing leaf shows broad bands and streaks of a pale yellow-green colour, stretching from midrib to edge.

discovered, but the juice from every part of a mosaic plant is highly infective, and if rubbed into the leaf of a healthy plant it will cause that plant also to develop the mottling in its youngest leaves. The infective juice may be spread by the hands and tools of workers, and especially by sucking insects, such as aphis. A plant once attacked never recovers, and the leaves remain infective even when dry. It is

FIG. 24.—Curly Leaf. [Photo by H. King.

possible that the disease may overwinter on certain perennial native weeds. Control of mosaic is very difficult. Infection early in the season is the most troublesome, and it can be to a certain extent postponed by spraying seed-beds with tobacco extract to control aphis and by pulling out any seedlings that develop mosaic. The disease, as far as is known, is not carried over on seed from affected plants.

DISEASES OF UNKNOWN CAUSE.

The diseases described above are all due to the presence of a definite parasite or (for mosaic) of an infective principle which can reproduce the disease by artificial inoculation. A number of other disorders occur, however, of which the cause has not yet been discovered, and which in some cases are probably due to unfavourable conditions in soil, moisture, or climate.

(1) Leaf-spots of unknown cause are illustrated in Figs. 19, 20, 21, 23.

FIG. 25.—Splitting of Leaf.

(2) Curly-leaf is a curious disease which has appeared rather abundantly in certain fields. The plants grow to normal height, but the leaves are strongly inrolled upwards (Fig 24). The veins are very prominent and velvety on the lower surface, and the whole leaf may become coiled and twisted. It is not yet known whether the disease spreads, but affected plants are valueless and, as a safeguard, should be destroyed wherever they appear.

(3) Splitting of the leaf between the veins has been seen frequently, and in some cases is responsible for appreciable loss. The result is similar to that produced by hailstorms, and the whole leaf may tear, without apparent reason, into ribbon-like strips (Fig. 25).

FLOWERING PARASITES.

All the parasites described above are either thread-like fungi, or bacteria even more minute in size. Tobacco is also attacked by another plant of its own kind (*Orobanche*) which fastens upon its roots and absorbs nourishment from them. The victim is either killed or much weakened, and finally the parasite grows out above the ground, produces flowers, and sets seed. The flower-heads should be cut down, if possible, before seed has been formed and scattered.

DISEASES OF "NICOTIANA RUSTICA."

RUST.

Rust in *N. rustica* is caused by the fungus *Macrosporium longipes*, which produces pale rusty rough spots scattered over the leaves. The same fungus produces red rust in tobacco.

WILT.

Wilting of *N. rustica* plants is caused by the fungus *Sclerotium rolfsii*, which produces a white cobweb-like weft over the outside of the roots and attacks the base of the stem. Small brown fruit-bodies, the size of a pin's head, are formed on the bark and serve to perpetuate the disease. The same fungus attacks a large number of plants, including cotton, cowpea, peanut, tomato, potato, and probably tobacco also. These crops should therefore be avoided as far as possible where an infestation has occurred. Diseased plants should be destroyed if possible.

It is probable that *N. rustica* is also attacked by the Fusarium wilt (q.v.).

FLOWERING PARASITES.

The flowering parasite *Striga* attacks and feeds upon the roots of *N. rustica*, as *Orobanche* does upon tobacco. The flower-heads of the parasite should be cut down.

WEEDS OF SOUTH AFRICA.

By K. A. LANSDELL, Botanical Assistant, Division of Botany, Pretoria.

XXI.

[Like other countries, South Africa is awaking to the importance of suppressing its noxious weeds, which, owing to the alarming rapidity of their spread in recent years, are becoming increasingly dangerous to our pasturage, wool, and other agricultural pursuits. While much has been done in the past to place the farmer in a position to recognize and cope with the danger, the problem grows in seriousness, and the time has arrived when all information regarding the noxious weeds found in the Union should be gathered into one publication for the use of the farmer, the student, and the general public. This work has now been undertaken by the Division of Botany, the opening contribution, continued hereunder, appearing in our April, 1921, number. The publication, which includes an illustrated glossary on the morphology of weeds, is the first of its kind in South Africa, and will continue to appear in serial form in the *Journal*. Thereafter, the series will be reprinted in bulletin form, with the addition of a coloured plate illustrating each weed dealt with.—EDITOR.]

Weed No. 16.

THE KHAKI WEED (*ALTERNANTHERA ACHYRANTHA*, R. BR.)

Order *Amaranthaceae*.

THE "Khaki Weed," known botanically as *Alternanthera achyrantha*, R. Br., is a native of South America and was probably introduced into this country with forage during the Anglo-Boer war. It usually grows in waste places.

The plant is frequently found mixed with baled hay, or straw used for packing, and if it is allowed to grow in cultivated lands the "seeds" may be present in the crop as an impurity. When growing on the banks of rivers, the "seeds" may be carried long distances by flood-waters and form new infected areas lower down the river.

The "seed" is very minute, circular in outline, black, shining.

The germinating capacity of the seeds has been tested and gave the following results:—

Number of Seeds Planted.	Planted.	Radicle appeared.	Cotyledons appeared.	Germinating capacity.
100	20th July, 1922	10th August, 1922	15th August, 1922	59 per cent.

PLATE I.

The seeds were sown in damp sawdust on the 20th July, 1922, and placed in the greenhouse. The radicle appeared twenty days after planting and the cotyledons twenty-four days after planting. The cotyledons are green in colour, ¼ inch long, linear, smooth; the plumule was visible one day later than the cotyledons, and the leaves were formed six days after the appearance of the plumule. The latter are oblong, dull green in colour, finely pubescent (Plate I). The seedlings were planted out and produced "burs" during the months of November to February. One plant is capable of producing from 1,000 to 3,500 seeds.

The "Khaki Weed" is a prostrate creeper (Plate III). It rarely attains a height of more than three inches, but a single plant may cover an area of six square feet, and owing to the dense

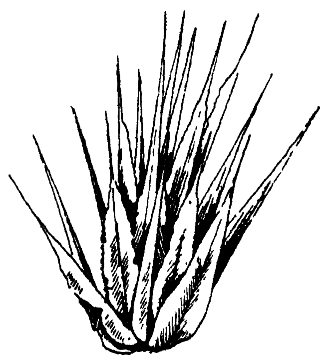


PLATE II.

"Bur," enlarged : *Alternanthera achyrantha* K. Br.

growth it effectually prevents any other plant forcing its way through. From the nodes of the creeping stems adventitious roots are formed which help to anchor the plant more firmly to the soil. The leaves are grey-green in colour, opposite and rather variable in shape, but usually somewhat ovate. The small "burs" occur either singly or in clusters in the axils of the leaves. At first they are quite soft and of a pale cream colour, but later on as the plant matures they become sharp and hard and of a dirty straw colour. When fully ripe they become detached from the plant (Plate III).

Eradication.—The plant should be dug out as soon as possible to prevent the formation of "burs." In attempting to destroy this weed, care should be taken to pull out the adventitious roots as well as the main root.

PLATE III.
Portion of Plant : "The Khaki Weed," *Alternanthera achyrantha* R. Br.

The "Khaki Weed" is a proclaimed noxious weed in the following areas (at date of publication):—

TRANSVAAL MUNICIPALITIES.

Belfast, Germiston, Pretoria, Heidelberg.

ORANGE FREE STATE.

Throughout whole Province.

CAPE.

Divisional Council Area.	Municipal Area.
Bedford.	Alice.
Cradock.	Bedford.
Elliot.	Capetown.
Kingwilliamstown.	Cradock.
Maclear.	Elliot.
Victoria East.	Somerset East.

Summary of information for use in the recognition of the weed, dissemination, and eradication.

Vernacular name ...	Khaki Weed.
Scientific name ...	*Alternanthera achyrantha*, R. Br.
Duration	Annual.
Fruit	A "bur."
Leaf...	Grey-green in colour, ovate.
Seed	Minute, black, shining.
Habitat	Waste places.
Dissemination ...	By "burs."
Eradication... ...	Prevent seed production.

CODLING-MOTH IN APRICOTS.

Report of Studies of Codling-moth at Wellington during the 1925-26 Fruit Season.

By F. W. PETTEY, Ph.D., assisted by C. J. JOUBERT, B.Sc., Elsenburg School of Agriculture and Experiment Station.*

OWING to the extraordinary abundance and destructiveness of codling-moth in apricots in Wellington for several years, the investigations of this pest, begun in 1924, were continued in 1925-26 to determine (*a*) the life-history and habits of the insect, (*b*) the effects of climatic conditions on its abundance, (*c*) the efficiency of banding trunks of trees in its control, and (*d*) the practicability of lead arsenate spraying.

A report on the first year's work, together with an account of the life-history of the pest and a description of the stages of the insect, illustrated, was published in the *Journal of the Department of Agriculture,* July and August, 1925 (issued as Reprint No. 33, 1925).

EXTENT OF INJURY.

Observations in ten different orchards show that although there was considerably less infestation this season than the last, the injury was still sufficiently great to cause concern among fruit growers. The average infestation in the district where codling-moth is well established and where little or no attention has been given to control measures was from 10 to 15 per cent. The infestation was lighter in orchards of trees having smooth bark and considerably heavier in some orchards of trees having much rough or loose bark (Table 1). In those orchards where thorough banding had been practised for two seasons, the infestation was less than 3 per cent. The general improvement was due probably to the exceptional heat of the 1924-25 summer having killed a large percentage of larvae in cocoons, which resulted in comparatively few larvae surviving to winter over and develop into spring moths (Table 6, Reprint No. 33).

Nineteen adult codling moths have been bred from 46 infested loquats in the Cillie orchard. The remaining larvae hibernated.

SEASONAL HISTORY.

Records of the emergence of 141 spring-brood adult moths were taken at Wellington in 1925 (Table 2), in comparison with records of 415 spring moths in 1924. The earliest spring moths appeared on the 9th of September in 1925, and on the 6th in 1924. In 1925 the spring

* The records on which this report is based were made by Mr. C. J. Joubert under the direction of Dr. F. W. Pettey.

moths were emerging in large numbers during the whole of October, and in 1924 during the last week of September, the whole of October, and the first two weeks of November. Records of the emergence of as many moths in 1925 as in 1924 would probably have shown the appearance of a large number over a somewhat longer period than the records indicate. Four hundred and fifteen moths emerged in 1924 over the long period between the 6th of September and the 26th of November, but one hundred and forty-one moths in 1925 emerged between the 9th of September and the 14th of November.

It is impossible to determine the comparative effect of weather conditions these two seasons on the moth emergence, as no temperature records could be taken during 1924. It may be stated, however, that the summer of 1925-26 was abnormally cool with the exception of a very few days, and in 1924-25 it was unusually hot.

In the spring of 1925, eggs did not begin to hatch in appreciable numbers until about the end of the third week of October (Tables 2 and 3). The earliest eggs laid by the first moths developing from the hibernating larvae hatched the 10th of October, a month after the Royals and five weeks after the New Castles had dropped all their petals. This almost coincides with the date of the hatching of the earliest eggs during 1924. Consequently, a codling spray, to be most effective in control, should have been applied this season during the second week of October. Further investigations, making use of a larger number of hibernating larvae, are necessary to determine if this interval between the time of setting fruit and hatching of the earliest eggs is constant every season.

Although the maximum emergence of spring moths occurred during the second week of October in 1925, probably a very large number of eggs was laid in the orchards between the 12th and 16th of October, during which period the night temperature was higher than at any time from September to January (Table 4). Moths are known to lay a maximum number of eggs when the night temperature is above 60° F. The spring months both of 1924 and of 1925 were on the whole continually cool, which doubtless prolonged the length of time during which the spring moths emerged, and influenced somewhat the number of eggs deposited and the time of maximum hatching. The maximum hatching of eggs of the first generation occurred the first week of November. If it were possible to apply a second spray on apricots for codling control, the correct time during 1924 and 1925 would have been, according to records, the first three or four days of November, or just before the maximum hatching of the first-brood eggs.

The First Generation.—The earliest eggs, which were exposed to rather cool weather, hatched in twelve days. Eggs laid later in the season hatched in six days.

Larvae hatching from the early deposited eggs fed in Royal apricots on the trees from 32 to 50 days before leaving the fruit to spin their cocoons (Table 5). Only one individual of 18 feeding in Royal apricots, the ancestors of which were bred in apricots, developed to an adult during the season. This larva remained transforming in its cocoon 59 days before it developed to an adult. The remaining 17 larvae hibernated. It is interesting to note that 9 individuals of 13 feeding in Royal apricots even somewhat later, the ancestors of which were bred in pears, developed into adult moths during the

season. Thus a much smaller percentage of those whose ancestors were bred in pears hibernated than in the case of those whose ancestors bred in apricots.

The life-cycle of those individuals which fully developed occupied from 62 to 75 days. Larvae remained developing in cocoons to adults from 19 to 59 days.

The earliest larvae of the first generation to leave the fruit appeared in the bands of Alpha trees on the 25th of October; in those of Royals the 27th of October; and in those of pear trees in Wellington the 29th of October. The pear trees were few in number and were surrounded by apricot trees. It is likely, therefore, that one or both of the parents of some of the larvae from the pears came from apricots, and that the pear and apricot strains of the insect in the orchard are somewhat mixed (Tables 6, 7, 8, and 9).

The Second Generation.—Many larvae of the first generation again this season wintered in cocoons and did not develop into moths until the next spring. Consequently, there was a small second generation (Tables 6-9).

The earliest adult moths of the first generation appeared during the second week of December in 1925, and on the 5th of December in 1924.

The earliest eggs of the second generation hatched the 13th of December. Consequently, larvae of this generation could not possibly complete their development before the beginning of the second week of January. Since all varieties of apricots were picked by the end of December except possibly a few Late Capes and Tiltons, there could have been only a rather light infestation by second generation larvae in Wellington apricots.

Overlapping of Generations.—The latest spring moths to emerge from 141 wintering cocoons appeared on the 14th of November, and the earliest adult moth of the first generation reared from Royals appeared on the 11th of December. Moths bred from daily collections of larvae from bands on trees in the orchard continued to emerge until the 2nd of March. Consequently there was only a short period towards the end of November and the first week of December when moths were not emerging in the orchard during the whole of the fruit season from the 9th of September until the beginning of March. So, except for a short interval during approximately the first ten days of December, larvae were hatching and attacking fruit from the second week of October until the very end of the fruit season.

Wintering of Larvae and its Significance.—Twenty-four Royal, twelve Alpha, twelve Late Cape apricot trees and five pear trees were banded in early spring with a double strip of hessian, and larvae were daily collected from them. Of the 635 larvae collected from the Royals, 81, or 11 per cent. developed into adult moths during the season, and the rest hibernated (Table 7). One hundred and twenty-one, or 46 per cent. of the two hundred and sixty-one larvae collected from the bands of the Alphas developed into adults during the season, and the remainder hibernated (Table 6). Ninety-one, or 10 per cent., of the eight hundred and thirty-seven larvae collected from the Late Capes developed into adults, and 90 per cent. hibernated. Two hundred and eleven, or 33.3 per cent., of the 633

larvae collected from the pears developed into adult moths during the season, while 66.6 per cent. hibernated (Table 9). Twelve Royal apricot trees in the orchards were banded early in the season with hessian, and larvae were allowed to collect in them without disturbance during the whole season until the 20th of March. When they were examined on that date, twenty-nine larvae were found dead in the cocoons under the bands, one hundred and forty-six living wintering larvae were found in cocoons, and there were eleven pupa cases from which adults had emerged (Table 13). These records show that in 1926 only 15 per cent. of the codling larvae succumbed to heat in the bands on trees in the orchard, 93 per cent. of those surviving the summer temperature would pass the winter in cocoons, and only 7 per cent. developed into moths during the season. It is of interest to note that in the summer of 1925 a much greater percentage, i.e. 68 per cent., succumbed to heat because of the much higher prevailing temperature, while approximately as many hibernated as in 1926. Consequently, it may be assumed that those growers who gave no attention to banding this season will experience a considerably greater infestation next season than during the past one.

A cursory examination of the records of hibernation to be found in these tables might wrongly be taken to indicate, because of the great difference in the percentage of larvae hibernating which were collected from the several apricot fruit varieties, that the percentage was influenced by the kind of apricot in which the larva fed. A careful perusal, however, will show that this was not the case, and that the variance was due to the difference in the length of the periods over which the larvae were collected. Ninety and eighty-nine per cent. of the larvae collected from the Royals and Late Capes respectively, in comparison with fifty-four per cent. from the Alphas, hibernated. This difference was due to the fact that larvae were daily collected from the two first varieties, which are comparatively late maturing, up to near the end of December, while from the Alphas, which were harvested much earlier, they were collected only until the last of November. A much higher percentage of late than early developing larvae hibernated. Even though larvae were daily collected from the bands of pear trees until the end of December, the comparatively smaller percentage of larvae which hibernated is explained by the fact that most of the larvae appeared in the bands during November, while a higher percentage appeared in the bands of the Royals and Late Capes in December.

These records confirm the conclusions formed from last season's observations, i.e. that codling moth is able to maintain itself in apricot orchards from year to year because the great majority of the first generation of codling larvae which develop in apricots hibernate. If the majority were to develop into moths the same season in apricot orchards where there were no late maturing stone fruits such as Kelsey plums or other host fruits, such as pears and apples, the pest would be negligible since the late larvae hatching from eggs would have no food on which to subsist or in which to develop.

Since a comparatively much smaller per cent. of larvae from Alphas and other early ripening varieties hibernated, one would expect less infestation in the early than in the late fruits because

of the smaller number remaining over the winter to develop into moths and continue the infestation. Such was not the case, however. Observations in the district show that the early varieties are as badly infested as the late ones, if not worse. This is probably due to the greater attraction of the more mature fruits to the spring moths. It has been noted that the roughness of the bark, or in other words, the age of the trees, as well as the degree of shade furnished by the trees has much influence on the degree of infestation in orchards. Young trees of all varieties with smooth bark are seldom badly infested, due probably to the fact that the larvae which develop in the fruit of such trees must seek sheltered spots in the soil where they very likely succumb to heat. Wellington soil is of such nature that it becomes almost incredibly hot on a summer day. The rougher the bark of the tree the more larvae can find shelter, which furnishes protection from the extreme heat often prevailing in the Wellington orchards (Table 1).

Factors Influencing the Percentage of Hibernation of First Generation Larvae.—It has been concluded from past investigations of the biology of this insect in some fruits at Elsenburg that the great majority of the first generation of codling larvae, which develop in pears and apples, transform into adult moths during the season, and that there is a large second generation (Department of Agriculture Science Bulletin No. 9, 1919). Why then, in the Wellington apricot orchards, does the great majority of the first generation larvae hibernate?

Codling eggs laid by Elsenburg pear codling-moths were transferred to Royal apricots in Wellington where the larvae which hatched were bred on the trees in the fruit caged in muslin bags (Table 5). At approximately the same time, and even somewhat earlier, the life-cycle of apricot codling larvae, the ancestors of which were bred in Wellington apricots, was obtained. Only one codling larva of the eighteen bred in Royal apricots, the ancestors of which were reared in Royal apricots, developed to an adult moth during the season. The rest hibernated. Nine codling larvae of thirteen bred in Royal apricots, the ancestors of which were bred in pears at Elsenburg, developed into adult moths during the season, while only four hibernated. This, together with last year's records, shows that there is in Wellington practically a one-generation strain of codling, and indicates that the high percentage of larvae hibernating is influenced by the medium in which the larvae or their ancestors have fed. High temperature possibly does not have as great an influence on the retardation of development to maturity as at first supposed. Further experiments are necessary to confirm these conclusions.

Explanation of the comparatively lower Infestation in Apricot Orchards than in Pear Orchards.—It is commonly known that the average infestation in a non-sprayed pear or apple orchard is over 90 per cent. Few Wellington apricot orchards, where no control measures have been practised, have experienced an infestation as high as 30 per cent. The records of 1925-26 again show that the infestation in Wellington apricots, where the pest has been established for a number of years, is lower than in commercial pear orchards because of the following reasons:—

Firstly, because a large number of first-generation larvae succumb to heat; secondly, because the majority of the surviving larvae of the first generation winter over, resulting in a comparatively very small second generation of larvae; and thirdly, because apricots are exposed to infestation a much shorter period than pears since the former mature more rapidly.

Very few larvae died during attempts to establish themselves in unsprayed fruit. Sometimes after a young larva burrows through the skin, no more than one-tenth of an inch from the surface a drop of gum-like material forms and hardens. Only three dead larvae were found in over one hundred of these "stings" which were inspected. One hundred and twenty-four newly hatched larvae placed on apricot fruits caged in muslin bags on the trees produced one hundred and ninety-three infestations, of which one hundred and fifty-six were undeveloped or "stings" (Table 15). This indicates that one codling larva may burrow through the skin of several fruits, thus injuring them, before it finally establishes itself in a fruit and develops to maturity there. The percentage of stings varied from thirty-one to forty-eight in Alphas, and from forty-eight to sixty-seven in Royals, in 1926 (Table 10). These "stings" have no bad effect on fruit destined for the jam factory or for drying, but are serious when they occur in fruits grown for export.

There is a very high mortality amongst hibernating codling larvae in the Wellington District, but most of the moths which emerge in the spring probably lay practically all the eggs that they are capable of producing because of the favourable temperature prevailing in this area during their emergence period.

INVESTIGATIONS OF CONTROL MEASURES.

Thinning of Fruit (Table 11).—Four unsprayed medium sized Royal trees, bearing a fairly heavy crop of fruit, were thinned of fruit sufficiently on the 6th of October to avoid the possibility of any two fruits on a tree touching each other until at least they were full grown. Records of these trees were compared with those obtained from four unthinned adjoining Royal trees of approximately the same size and age, which were also not sprayed.

The four thinned trees matured only about half as many fruits as the four unthinned. Thinning done before eggs begin to hatch naturally results in the exposing of the smaller number of fruits on the tree to practically as many codling larvae as occur on an unthinned tree in the same vicinity, containing comparatively many more fruits. In view of the fact that eggs did not begin hatching in appreciable quantities until the second week of October, and thinning was done on the 6th of October, it is surprising that the infestation did not increase greatly in the crop of the thinned fruits. The infestation of the fruits on the thinned trees was 9 per cent. in comparison with 8.2 per cent. on the unthinned. The results suggest that thinning does not appreciably increase the percentage of infestation in the fruit of an unsprayed tree.

However, there is every possibility that thinning even before the eggs begin to hatch in the orchard, would tend to make spraying more effective in the control of the pest if spraying were practical. The records show that a large proportion of larvae entered the sides

of the fruit at a point where two fruits touched. It is impossible to force spray in between fruits which press against each other. Thinning in such a manner as to avoid making it possible for one fruit to touch another reduced greatly the number of larvae entering the sides of the fruit.

Thirty-three " extra selected " and one hundred and ninety " selected " fruits were obtained from the four thinned trees in comparison with four " extra selected " and one hundred and four " selected " from four unthinned trees. The trees from which these results were obtained were of middle age. Probably younger trees would respond more to thinning. Since judicious thinning increases the numbers of fruits of these sizes suitable for export, it seems that it would pay the exporter to thin. To determine this question definitely, however, the price obtained for export and for fruit used for drying and canning would have to be considered.

As the dried fruit companies pay a higher price for large fruit than for small it seems equally possible that it would be advisable for the grower who produces for drying to thin. Since the four unthinned trees produced about twice as many pounds of fruit as the thinned, it is evident that it would not pay the apricot grower to thin who sends his fruit to the canning factory, where at present no distinction in price is made between small and large fruit. It should be borne in mind, however, that the price of fruit paid for canning is governed by the world's market price paid for dried fruit, and that quality influences the price obtained for the latter.

Whether the grower thins or not early in the summer for the purpose of improving the quality of the crop, the seeking out and destruction of wormy green fruits should be considered a most important part of orchard practice.

The earliest larvae began to leave the fruit on the 25th of October. Consequently, the grower should concentrate on the picking off and destruction of all wormy fruits early enough in October to avoid the possibility of any larvae escaping to winter over and infest the orchard during the coming year. During October, larvae remained feeding in fruit on the trees about a month before they matured and left it, but later in the season, when the fruit was riper and the temperature higher, they probably remained in the fruit no longer than three weeks. New infestations occurred almost daily during the summer in orchards where the pest occurred in considerable quantities. Consequently every tree should be closely inspected once every two weeks, beginning about the middle of October and continuing until the fruit is harvested, and every wormy fruit found should be properly disposed of to prevent the development and escape of the larvae.

The Importance of the Single Band in the Control of Codling (Table 12).—Owing to the fact that spraying has not yet been found to be a practical measure of control of codling in apricots, the question of the efficiency of a band of hessian around the trunk of each tree in the trapping of codling larvae is an important one.

A double folded strip of rather thick sacking or hessian was placed around the trunks of four old Royal apricot trees, the bark of which was not scraped, and four old Royals, the bark of which was previously thoroughly scraped. Four younger Royal trees with smooth bark were similarly banded. Four old Royals, the rough

bark of which was previously scraped, were similarly banded, and in addition a strip of hessian was placed around each main branch. One of these four trees had also a strip of tanglefoot placed around the base of the trunk.

To determine the percentage of larvae leaving the fruit which escaped capture from the bands, windfalls of the trees were picked up daily, and those infested fruits which larvae had left were recorded. The same procedure was made with the picked fruits of these trees. The larvae were collected every fortnight from the bands. Fifty-four larvae were caught in the bands of the four old trees with rough bark not scraped, and two hundred and thirty-nine fruits were obtained from these trees from which larvae had emerged. These bands captured only 22.5 per cent. of the worms, while the bands on the old trees with scraped bark captured 62 per cent. of the worms which had left the fruit. The bands on the trees with smooth bark captured 75.1 per cent. of the worms that emerged from the fruit. The bands on the single old scraped tree with tanglefoot around the base captured 87.3 per cent. of the worms which left the fruit. A fair test of double banding on the three trees mentioned could not be made because of the presence of numerous unavoidable cracks in the bark of branches and trunks, which lessened the efficiency of the bands.

These rather limited tests show that the degree of efficiency of banding in the control of this pest depends on the degree of smoothness of the bark of trunks and branches and thoroughness of scraping of loose bark from old trees. Banding of old trees with rough bark is almost useless unless the loose bark is thoroughly removed from branches and trunks, with special attention given to the scraping of the crotches of large branches at the top of the trunk where the main branches originate. The removal of all loose bark not only tends to concentrate larvae in the bands, but it increases the mortality of the worms that avoid the bands, by exposing them to heat during the summer as a result of destruction of places of shelter.

However, growers should avoid such severe scraping as to result in cutting living bark, and consequent excretion of much gum in those areas since it is not yet known what effect this degree of scraping has on the health of the tree.

The bands should be placed on the trees in Wellington apricot orchards during the third week of October, just before the earliest larvae leave the fruit (Tables 6, 7, 8).

As the larvae which first appeared in the bands this season developed into the earliest moths on 11th December in 1925 and on 5th December, 1924, it is only necessary to collect larvae once from the bands of early maturing varieties, providing harvesting of their fruit is finished by the 1st of December, and providing that all larvae are collected from the bands of these trees as soon as the fruit is picked. It is necessary, however, to band the early varieties, because some worms escape from them before the fruit is picked. Two hundred and sixty-one larvae were collected from the bands of twelve Alpha trees in the Cillie orchard during 1925 before the fruit was harvested on the 26th of November (Table 6). If bands are not put on to capture these early developing larvae, some of those which escape become moths that increase the infestation in late fruits, and others winter over and become spring moths the following season.

The larvae must be collected from bands often enough to avoid any possibility of their developing into moths which would fly from the bands and escape. The maximum interval allowable between collections must be the minimum interval between the time when any larvae enter the bands and the time when the adult moths develop from them. In pear orchards at Elsenburg this has been determined to be fourteen days. Observations in Wellington indicate that it may be a considerably longer period in apricots (Tables 6, 7, 8). To know definitely what the maximum interval may be is of considerable importance to apricot growers, since the collections must be made during the busy season of harvesting and drying. Until this question has been further studied, however, the grower is advised to collect the larvae once every two weeks in Royals and later ripening apricots, beginning the last week in November and continuing until the fruit is harvested.

Spraying Apricots to control Codling (Table 14).—Arsenical spray tests were limited to comparatively few trees this season because of the serious burning of foliage and fruit in 1925.

Two rows of eight trees were sprayed once on the 19th of October with a mixture of 1 lb. of Capex acid lead arsenate powder and 3 lb. of freshly slaked lime in 40 imperial gallons of water. Two adjoining rows of eight trees were sprayed once with 1 lb. of Electro acid lead arsenate powder and 3 lb. of freshly slaked lime in 40 gallons of water. Two trees were sprayed a second time on the 2nd of November with this mixture. The next two rows were sprayed on the 19th of October with 1 lb. of Electro acid lead arsenate in 40 gallons of water without lime, and two weeks later two of the trees in these rows were sprayed a second time with the same mixture. Rows 8 and 9, consisting of 8 trees, were sprayed once with Capex acid lead arsenate powder in 40 imperial gallons of water without lime. Rows 10 and 11 were sprayed once with a neutral lead arsenate, obtained from the California Spray Chemical Company, at the rate of 1½ lb. in 40 imperial gallons of water, and rows 12 and 13 received two applications of this mixture.

Although the summer was abnormally cool, even more foliage burning resulted on trees sprayed either once or twice with acid lead arsenate, with or without lime. Less burning of fruit occurred than during the previous season. Electro and Capex acid lead arsenates burned equally severely. Although trees sprayed once with freshly slaked lime in the mixture had the foliage less severely damaged than that of trees sprayed either once or twice without lime, they dropped half their leaves by midsummer. Leaves of trees sprayed with the neutral lead arsenate were only very slightly injured by the spray, so little that it was scarcely noticeable, and the burning was limited to the side exposed to an unusually severe hot wind which occurred in November.

The results indicate that not even a single application of acid lead arsenate powder at the rate of 1 lb. in 40 imperial gallons of water with 3 lb. of freshly slaked lime can be safely applied to apricots without the risk of severe burning of leaves and premature defoliation of the trees.

Further tests of neutral lead arsenate must be made to determine its efficiency and effect on foliage and fruit before the question of its advisability as a spray can be determined.

The trees varied considerably in their susceptibility to spray burn according to their condition. It is possible that trees growing in deep fertile soil would be much more resistant to spray injury than those growing in less suitable conditions.

SUMMARY AND CONCLUSIONS.

Codling-moth continues to be a serious pest of apricots in many Wellington orchards, where practically no pear, apple, or quince orchards exist, and it appears to be slowly spreading to most orchards in the district. It has now been reared from loquats.

The infestation in apricot orchards in 1925-1926 was not so great as in 1924-1925, because of the more general adoption of banding in the district, and because of the heavy mortality of larvae in cocoons in the orchards, resulting from the continued extreme heat of the 1924-1925 summer. The average infestation in 1925-1926 was 10 to 15 per cent. in orchards where no efforts were made to control the pest.

It was found that 31 per cent. of the infestations in Alphas and 48 to 67 per cent. of those in Royals did not become serious except for the exporter of fresh fruits, owing to the fact that either the larvae left these fruits soon after they burrowed through the skin, or died prematurely. One codling larva may infest or injure several apricots before it finally establishes itself in a fruit to develop to maturity.

The seasonal history of this insect during 1925-26 almost coincided with that of 1924-25. One hundred and forty-one moths began to emerge from over-wintering cocoons in the orchard on the 9th of September and continued until the middle of November. The earliest laid eggs hatched in the orchard on the 16th of October, a month after Royals had dropped their petals and five weeks after the New Castles had dropped theirs. The majority of codling eggs of the first generation hatched in the orchard during the last week of October and the first week of November. Eggs of the second generation did not hatch in appreciable numbers until about the third week of January, when all apricots were picked. The earliest eggs of the second generation began to hatch in the orchard about the 13th of December. The earliest larvae remained feeding in the fruit from five to six weeks.

When the fruit was properly thinned many fewer larvae entered the sides than when it was not thinned. Thinning increased greatly the tendency of larvae to enter the fruit in the groove round the stem.

Owing to the prevailing abnormally cool weather only 15 per cent. of the larvae in the bands succumbed to heat during the 1925-26 summer season in comparison with about 65 per cent. during 1924-25. It is anticipated, therefore, that codling infestation will be greater next year than it was this season in apricot orchards where no banding of trees to control the pest was practised.

Eighty-nine to ninety per cent. of the larvae of the first generation, collected from the bands of Royals and Late Capes respectively, did not transform during the season, but only 64 per cent. of the larvae of the first generation, collected from Alphas, failed to develop to moths. The rest developed into moths the same season.

Over 90 per cent. of the apricots grown in Wellington are Royals. The great majority of the first generation of larvae, which feed in this variety hibernate, and there is only a comparatively small second

generation in most orchards. This explains why codling-moth is able to maintain itself year after year in apricot orchards.

Thinning so that no two fruits touch each other when they are full grown apparently increased the number of "selected" and "extra selected" fruits in a crop, but greatly decreased the crop in weight. It is therefore questionable if thinning to this extent would at present pay the grower who disposes of his fruit to the canner, but the value of thinning to the grower who exports either the fresh or the dried fruit should be considered. Thinning experiments, however, should be repeated several years for reliable conclusions.

A double folded single strip of grain sack placed firmly around the trunk of apricot trees captured 75 per cent. of the larvae leaving the fruit when the bark was smooth; about 60 per cent. when the rough bark of trees was thoroughly scraped to remove natural places of shelter; and only about 20 per cent. when the rough bark was not scraped.

Bands should be placed on trees the third week of October. Larvae need be collected only once from the bands of early maturing varieties, providing the fruit is harvested before the 1st of December, and providing all larvae are collected from the bands of these trees not later than the first week of December. It has not yet been determined with certainty how long may be the interval between collections of larvae from bands of later ripening varieties, but it is probable that it may be at least as long as three weeks.

If the bark of trees is so scraped as to result in the cutting of living wood, excretion of considerable gum from the cut surface results. It is not known if this injures a tree appreciably. Only dead bark should be removed.

Not even one spray of acid lead arsenate powder at the rate of 1 lb. in 40 gallons of lime-water can be advised for the control of codling in apricots, as serious burning of foliage and premature defoliation occurred during the 1925-26 season. One or two applications of neutral lead arsenate at the rate of $1\frac{1}{2}$ lb. of powder in 40 gallons of water caused only slight burning of foliage, and gives promise of being safe to use, but tests must be repeated and its efficiency in control tested before the question of its practicability for codling control in apricots can be determined.

As a result of two years of study of this pest in Wellington apricot orchards, it is thought possible to control it satisfactorily (*a*) by banding the trees properly the last of October and collecting the larvae from bands regularly once every two weeks from the end of November until the crop is harvested; (*b*) by carefully scraping off all loose dead bark of branches, trunks, and crotches of old trees and killing all larvae found under such bark during the winter months; (*c*) by regularly picking off every tree as many wormy fruits as possible, and destroying the larvae by boiling such fruits in water for ten minutes, or by throwing them into vats of water covered with any kind of used engine oil, beginning the first of November and continuing until harvesting begins. Wormy fruits, picked off during harvesting, should either be treated promptly in the same manner, or, if the grower insists on the practice of using them commercially, they should be cut up for drying or disposed of to hawkers, etc., on the same day they are picked. The cutters should be required to kill

every larva found. Wormy fruits should on no account be left over night in boxes, trays, or piles in or near fruit storerooms or in the drying grounds, because the worms would escape from them to sheltered places where they would develop to moths and fly to the orchards in the spring.

Old trees having much rough or cracked bark should have at least one band of sacking placed around each large branch so as to be above as much rough bark as practicable, but low enough to intercept larvae that crawl down the branch after leaving the fruit.

The apricot grower should be impressed with the fact that every wormy fruit produced next season in his orchard will have originated from codling larvae that he allowed to escape from fruit in his orchard, drying grounds, or fruit-packing room this season.

Spraying cannot yet be recommended for the control of this pest in apricot orchards, and it is confidently expected that spraying will be unnecessary if the other measures of control, particularly banding, are thoroughly and properly practised.

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TABLE 1.

Estimate of Codling Infestation in different Orchards, Wellington, 1925-26 Season.

Name of Grower.	Varieties of Apricots.									Remarks.
	New-castle. *	Alpha. *	Alpha.	Early Reticf. *	Early Cape. *	Late Cape. *	Late Cape.	Royal. *	Royal.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
P. J. Malan.	2	—	—	—	—	—	—	2	—	Sprayed twice in 1924–25. Trees banded.
R. Taylor...	—	—	—	—	—	—	—	—	2	Trees banded in 1924–25. Bark not scraped.
C. Cillie.....	—	23	—	—	15	24	3	26	—	Trees banded. Bark not scraped.
J. Orffer.....	—	—	1	—	—	—	—	7	1	Trees not banded. Orchard infested only two years.
J. Hittos....	—	—	—	40	—	—	—	40	3	Trees not banded.
Koos Malan..	—	—	—	—	—	—	—	—	1	Trees banded.
Frans Malan.	—	—	—	—	—	15	—	—	7	Trees not banded or only a portion banded in 1924–25.

* NOTE.—Old trees with rough bark. The other trees had smooth bark. All bore a good crop of fruit. An average of about 80 per cent. of the infestations were "stings" or not developed sufficiently to injure the fruit for canning or drying.

TABLE 2.

Records of Emergence of Spring Moths, Wellington, 1925.

Dates of Emergence.	Number of Moths.	Dates of Emergence.	Number of Moths.
September 9	1	October 10–15	67
„ 10–15	2	„ 15–21	22
„ 16–21	1	„ 22–27	7
„ 22–27	3	„ 28–November 2	3
„ 28–October 3	13	November 3–8	1
October 4–9	19	„ 9–14	2
		TOTAL NUMBER OF MOTHS ..	141

TABLE 3.

Blossoming Dates of Trees and Dates of Harvesting, Wellington, 1925-26.

Varieties.	Full blossom.	Petals dropped.	Fruit all picked.
Alpha	—	—	November 26
New Castle	September 1	September 9	„ 17
Early Retief	„ 2	„ 11	„ 23
Early Cape	„ 2	„ 14	December 17
Royal	„ 6	„ 16	„ 21
Late Cape	—	—	January 5

TABLE 4.

Temperature Records taken out-of-doors in Apricot Orchard, Wellington, 1925-26.

Date.	October.		November.		December.		January.		February.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	76	44	78	50	77	51	—	—	95	52
2	79	42	75	50	79	49	77	53	—	—
3	78	48	74	54	78	49	—	—	—	—
4	80	48	80	53	83	50	84	50	—	—
5	81	45	81	48	88	51	88	50	—	—
6	58	46	81	54	92	61	68	52	94	54
7	52	50	85	52	85	62	88	54	—	—
8	52	48	87	55	81	57	91	55	—	—
9	51	50	94	58	76	48	91	55	—	—
10	52	50	80	55	85	53	—	—	—	—
11	61	58	77	55	92	52	—	—	—	—
12	71	70	70	58	81	52	—	—	90	52
13	66	64	83	56	75	55	92	54	—	—
14	74	62	88	55	68	56	90	57	—	—
15	61	60	65	49	79	52	—	—	—	—
16	71	70	61	53	89	54	—	—	—	—
17	88	52	76	49	83	54	—	—	—	—
18	89	53	92	55	74	46	100	57	—	—
19	90	60	81	55	82	49	—	—	—	—
20	90	56	70	57	85	58	—	—	—	—
21	68	50	75	61	79	51	98	59	—	—
22	65	50	84	58	91	57	—	—	—	—
23	70	53	80	58	99·5	54	—	—	—	—
24	73	48	75	55	88	56	—	—	—	—
25	81	51	74	52	90	54	96	61	—	—
26	86	51	83	51	90	57	—	—	—	—
27	89	55	64	50	83	54	—	—	—	—
28	65	50	65	49	85	56	95	52	—	—
29	68	47	64	48	79	50	—	—	—	—
30	67	48	72	52	84	53	—	—	—	—
31	70	48	—	—	—	—	—	—	—	—

29th September.—Max., 58; min., 54. 30th September.—Max., 60; min., 52.

TABLE 5.

Life-cycle of Codling-moths in Apricots, Wellington, 1925-26.

Egg Laid.	Egg Hatched.	Larva left Fruit.	Adult Emerged.	Approx. Days of Egg Incubation.	Days of Larva in Fruit.	Days in Cocoon.	Days of Life-cycle.		Ancestors bred in Apricots, A; in Pears, P.
							Ancestors bred in Pears.	Ancestors bred in Apricots.	
Oct. 2–6	Oct. 16	Nov. 20	—	12	35	*	—	—	A
2–6	" 16	" 28	—	12	43	*	—	—	A
2–6	" 18	" 27	Dec. 23	14	40	25	79	—	P
6–10	" 17	" 23	—	9	37	*	—	—	A
6–10	" 17	" 23	—	9	37	*	—	—	A
6–10	" 17	" 24	—	9	38	*	—	—	A
6–10	" 17	" 26	—	9	40	*	—	—	A
6–10	" 17	" 26	—	9	40	*	—	—	A
6–10	" 17	" 26	—	9	40	*	—	—	A
6–10	" 18	" 25	—	10	38	*	—	—	A
6–10	" 18	" 25	—	10	38	*	—	—	—
6–10	" 18	Dec. 7	—	10	50	*	—	—	A
6–10	" 18	Nov. 26	—	10	39	*	—	—	A
6–10	" 18	" 30	—	10	43	*	—	—	A
6–10	" 18	" 29	—	10	42	*	—	—	A
6–10	" 18	Dec. 1	—	10	44	*	—	—	A
6–12	" 19	Nov. 22	Dec. 17	10	32	24	66	—	P
10–12	" 19	" 25	—	8	37	*	—	—	A
10–12	" 19	" 26	Jan. 25	8	38	59	—	105	A
10–12	" 19	" 26	—	8	38	*	—	—	A
12–16	" 21	Dec. 1	Dec. 23	7	41	21	69	—	P
12–16	" 21	Nov. 30	—	7	41	*	—	—	P
12–16	" 21	Dec. 7	Dec. 27	7	48	19	74	—	P
16–20	Nov. 5	" 9	—	18	34	*	—	—	A
18–24	" 5	" 6	Dec. 27	15	31	20	66	—	P
18–24	" 5	" 12	—	15	37	*	—	—	P
18–24	" 6	" 3	Dec. 23	16	27	19	62	—	P
18–24	" 6	" 4	—	16	28	*	—	—	P
18–24	" 6	" 8	Dec. 29	16	32	20	68	—	P
18–24	" 7	" 8	Jan. 5	17	31	27	75	—	P
18–24	" 7	" 7	Dec. 29	17	30	21	68	—	P
18–24	" 9	" 9	—	19	30	*	—	—	P

* Larva hibernated.

TABLE 6.

Records of Daily Collection of Codling Larvae from 12 *Banded Alpha Trees, Wellington,* 1925-26.

Date Collected.	Number of Larvae.	Date of Emergence of Moths.	Number of Moths Emerging.
October 25	1	December 29, 1925	3
,, 26	1		
,, 27	3	January 2, 1926	2
,, 28	1		
,, 31	1	January 2–5, 1926	5
November 1	3		
,, 3	1	,, 5-9, 1926	9
,, 5	1		
,, 6	3	,, 9–13, 1926	21
,, 7	5		
,, 8	5	,, 13–14, 1926	18
,, 9	11		
,, 10	21	,, 14–18, 1926	16
,, 11	25		
,, 12	18	,, 18–21, 1926	5
,, 13	32		
,, 14	41	,, 21–25, 1926	31
,, 15	8		
,, 16	18	,, 25–28, 1926	6
,, 17	11		
,, 18	20	Jan. 28–Feb. 1, 1926	3
,, 19	8		
,, 20	8	Feb. 1–12, 1926	1
,, 21	4		
,, 22	2	,, 12–19, 1926	1
,, 23	3		
,, 24	1		
,, 25	1		
,, 26	3		
,, 27	1		
TOTAL	261		121

Percentage of moths which emerged during the season....... 46
Percentage of larvae which hibernated....................... 54

TABLE 7.

Records of Daily Collections of Codling Larvae from 24 Banded Royal Apricot Trees, Wellington, 1925-26.

Date Collected.	Number of Larvae.	Date of Emergence of Moths.	Number of Moths Emerging.
October 27..........	4	December 11, 1925	1
„ 28..........	1		
„ 29..........	1	„ 11–17, 1925	1
„ 30..........	1		
November, 1..........	5	„ 17–22, 1925	1
„ 2..........	2		
„ 3..........	3	„ 22–23, 1925	1
„ 4..........	2		
„ 5..........	1	„ 23–25, 1925	1
„ 6..........	2		
„ 7..........	1	„ 25–26, 1925	1
„ 8..........	1		
„ 9..........	2	„ 26–27, 1925	1
„ 10..........	1		
„ 11..........	3	„ 27–28, 1925	3
„ 12..........	5		
„ 13..........	10	„ 28–29, 1925	4
„ 14..........	7		
„ 15..........	1	December 29, 1925–January 2, 1926	3
„ 16..........	2		
„ 17..........	8		
„ 18..........	10	January 2–5, 1926	8
„ 19..........	8		
„ 20..........	7	„ 5–9, 1926	2
„ 21..........	9		
„ 22..........	14	„ 9–13, 1926	7
„ 23..........	20		
„ 24..........	17	„ 13–14, 1926	3
„ 25..........	17		
„ 26..........	33	„ 14–18, 1926	12
„ 27..........	14		
„ 28..........	9	„ 18–21, 1926	7
„ 29..........	13		
„ 30..........	28	„ 21–25, 1926	10
December 1..........	13		
„ 2..........	28	„ 25–28, 1926	3
„ 3..........	35		
„ 4..........	46	Jan. 28–Feb. 1, 1926	4
„ 5..........	45		
„ 6..........	34	February 1–6, 1926	3
„ 7..........	40		
„ 8..........	34	„ 6–12, 1926	2
„ 9..........	19		
„ 10..........	28	„ 12–19, 1926	2
„ 11..........	18		
„ 12..........	13	Feb. 19–Mar. 2, 1926	1
„ 13..........	4		
„ 14..........	3		
„ 15..........	2		
„ 16..........	8		
„ 18..........	1		
„ 19..........	2		
TOTAL.......	635		81

Percentage of moths which emerged during the season....... 12
Percentage of larvae which hibernated...................... 88

TABLE 8.

Records of Daily Collection of Codling Larvae from 12 *Banded Late Cape Trees, Wellington,* 1925-26.

Date Collected.	Number of Larvae.	Date of Emergence of Moths.	Number of Moths Emerging.
October 31	1	December 15, 1925	1
November 2	1		
„ 3	1	„ 15-16, 1925	1
„ 5	1		
„ 8	2	„ 16–18, 1925	1
„ 9	3		
„ 10	2	„ 18–21, 1925	2
„ 11	2		
„ 12	5	„ 21–25, 1925	1
„ 13	20		
„ 14	19	„ 25–26, 1925	1
„ 15	0		
„ 16	2	„ 26–27, 1925	4
„ 17	4		
„ 18	23	„ 27–28, 1925	1
„ 19	8		
„ 20	9	„ 28–29, 1925	1
„ 21	12		
„ 22	18	December 29, 1925–January 2, 1926	6
„ 23	13		
„ 24	12		
„ 25	19	January 2-5, 1926	9
„ 26	23		
„ 27	6	„ 5–9, 1926	12
„ 28	4		
„ 29	8	„ 9–13, 1926	5
„ 30	16		
December 1	15	„ 13–18, 1926	10
„ 2	22		
„ 3	33	„ 18–21, 1926	12
„ 4	29		
„ 5	50	„ 21–25, 1926	10
„ 6	30		
„ 7	36	„ 25–28, 1926	6
„ 8	49		
„ 9	55	Jan 28–Feb. 1, 1926	6
„ 10	60		
„ 11	65	February 1–19, 1926	2
„ 12	36		
„ 13	25		
„ 14	14		
„ 15	17		
„ 16	27		
„ 17	14		
„ 18	5		
19	8		
20	5		
21	4		
„ 22	1		
„ 23	1		
„ 24	2		
TOTAL	837		91

Percentage of moths which emerged during the season....... 10
Percentage of larvae which hibernated..................... 90

TABLE 9.

Records of Daily Collection of Codling Larvae from 5 *Banded Pear Trees, Wellington,* 1925-26.

Date Collected.	Number of Larvae.	Date of Emergence of Moths.	Number of Moths Emerging.
October 29..........	1	December 7, 1925.	5
,, 31..........	1		
November 1..........	1	,, 7–10, 1925.	1
,, 2..........	5		
,, 3..........	5	,, 10–11, 1925.	1
,, 4..........	8		
,, 5..........	5	,, 11–13, 1925.	1
,, 6..........	6		
,, 7..........	7	,, 13–15, 1926.	1
,, 8..........	17		
,, 9..........	25	,, 15–16, 1925.	2
,, 10..........	18		
,, 11..........	14	,, 16–19, 1725.	1
,, 12..........	17		
,, 13..........	55	,, 19–21, 1925.	1
,, 14..........	44		
,, 15..........	8	,, 21–22, 1925.	1
,, 16..........	22		
,, 17..........	21	,, 22–23, 1925.	4
,, 18..........	45		
,, 19..........	32	,, 23–25, 1926.	3
,, 20..........	13		
,, 21..........	14	,, 25–26, 1925.	2
,, 22..........	20		
,, 23..........	18	,, 26–27, 1925.	6
,, 24..........	13		
,, 25..........	24	,, 27–28, 1925.	3
,, 26..........	27		
,, 27..........	7	,, 28–29, 1925	9
,, 28..........	10		
,, 29..........	8	,, 29–30, 1925.	4
,, 30..........	9		
December 1..........	6	December 30, 1925–January 2, 1926	10
,, 2..........	10		
,, 3..........	12		
,, 4..........	13	January 2–5, 1926.	10
,, 5..........	8		
,, 6..........	5	,, 5–9, 1926.	19
,, 7..........	7		
,, 8..........	6	,, 9–14, 1926.	29
,, 9..........	2		
,, 10..........	5	,, 14–15, 1926.	7
,, 11..........	7		
,, 13..........	1	,, 15–18, 1926.	33
,, 14..........	2		
,, 15..........	3	,, 18–21, 1926.	10
,, 16..........	5		
,, 17..........	1	,, 21–25, 1926	24

Record of Daily Collection of Codling Larvae from 5 *Banded Pear Trees, Wellington,* 1925-26—(continued).

Date Collected.	Number of Larvae.	Date of Emergence of Moths.	Number of Moths Emerging.
December 19..........	1		
„ 20..........	2	„ 25–28, 1926.	12
„ 21..........	3		
„ 22..........	2	Jan. 28–Feb. 1, 1926.	9
„ 23..........	2		
„ 25..........	1	February 1–6, 1926.	1
„ 27..........	2		
„ 28..........	4	„ 6–19, 1926.	2
„ 29..........	2		
„ 30..........	1		
TOTAL.........	633		211

Percentage of moths which emerged during the season..... 33·3
Percentage of larvae which hibernated.................... 66 6

Pears of three trees were picked near the end of November, which accounted for diminishing number of larvae.

TABLE 10.

Percentage of Codling Infestation and " Stings " in certain Alpha and Royal Apricots, Wellington, 1925-26.

Variety.	Tree Number.	Number of Fruits.	Attacked Fruit.		Attacked Fruits with Stings only.	
			Number.	Per Cent.	Number.	Per Cent.
Alpha...........	1	891	225	25	71	31
Royal...........	21	793	205	25	137	67
Royal...........	2	453	116	25	56	48

TABLE 11.

Codling Infestation in Thinned and Unthinned Royal Apricots, Wellington, 1925.

Trees Thinned, 6th October.

No. of Tree.	Total Fruit.	Fruit Smaller than "Selected."	"Selected" Fruit.	"Extra Selected" Fruit.	Stem End Infestations.	Side Groove Infestations.	Side Infestations.	Top Infestations.	Total Infestations.	Per Cent. Infestations.	Weight of Fruit in lb.
1.........	335	237	50	17	28	3	2	1	34	10·1	37
2.........	761	679	30	1	27	17	8	3	55	7·2	70
3.........	448	343	50	6	43	5	2	—	50	11·2	42
4.........	458	354	60	9	32	2	8	—	42	9·2	47
TOTAL...	2,002	1,613	190	33	130	27	20	4	181	9·0	196

Unthinned Trees.

No. of Tree.	Total Fruit.	Fruit Smaller than "Selected."	"Selected" Fruit.	"Extra Selected" Fruit.	Stem End Infestations.	Side Groove Infestations.	Side Infestations.	Top Infestations.	Total Infestations.	Per Cent. Infestations.	Weight of Fruit in lb.
1.........	951	887	9	6	33	5	16	1	55	5·8	84
2.........	915	750	46	3	70	19	35	2	126	13·8	79
3.........	1,934	1,819	6	0	52	11	56	1	120	6·3	167
4.........	714	607	43	1	47	6	16	3	72	10·1	67
TOTAL...	4,514	4,063	104	4	202	41	123	7	373	8·2	397

TABLE 12.

Percentage of Codling Larvae caught in Bands, Wellington, 1925-26.

No. of Tree.	Number of Larvae that left Fruit.	Number of Larvae Caught in Bands.	Per Cent. of Larvae Caught in Bands.
Rough bark not scraped. Old trees, Single-banded.			
1	73	20	27·4
2	38	7	18·4
3	60	13	21·6
4	68	14	20·5
TOTAL	239	54	22·5
Young trees with comparatively smooth bark. Single-banded.			
1	10	8	80·0
2	29	20	68·9
3	26	18	69·2
4	52	42	80·7
TOTAL	117	88	75·2
Old trees with rough bark scraped. Single-banded.			
1	75	55	73·3
2	71	45	63·3
3	82	45	54·8
4	31	16	51·6
TOTAL	259	161	62·1
*Old trees with rough bark scraped. Double-banded.**			
1	61	40	65·5
2	45	21	46·6
3	16	6	37·5
TOTAL	122	67	54·9
Old tree with rough bark scraped. Double-banded, with tanglefoot strip around base of trunk.			
1	63	55	87·3

* The comparatively small catch of worms from these trees was due to the presence of numerous unavoidable cracks in trunks and branches, which lessened the efficiency of the bands.

TABLE 13.

HIBERNATING LARVAE.

Larvae accumulated during whole of Apricot Season in Bands of 12 Royal Trees, collected 21st March, 1926. Cillie's Farm.

No. of Tree.	Number of Living Larvae in Band.	Number of Dead Larvae in Cocoons.	Number of Empty Pupa Cases.	Number of Empty Cocoons containing Scavenger Larvae.*
1..........	4	—	—	—
2..........	2	1	—	—
3..........	2	2	—	—
4..........	9	—	—	1
5..........	17	4	—	4
6..........	3	1	1	3
7..........	11	—	4	—
8..........	10	—	1	3
9..........	19	—	—	—
10..........	15	1	2	1
11..........	37	1	1	2
12..........	17	4	2	1
TOTAL....	146	14	11	15

* It is assumed that the scavenger grubs had eaten dead codling larvae in their cocoons.

TABLE 14.

The Effect of Lead Arsenate Sprays on Royal Apricots, Malan's Orchard, 1925-26.

Number of Trees Sprayed.	Number of Sprays.	Date Sprayed.	Spray Material.	Percentage of Severe Spray Burn and Defoliation, 1st January, 1926.
8........	1	Oct. 19	1 lb. Capex lead arsenate powder, 3 lb. lime in 40 gallons water	50.
8........	1	Oct. 19	1 lb. Electro lead arsenate powder, 3 lb. lime in 40 gallons water	50.*
2........	2	Oct. 19; Nov. 2	1 lb. Electro lead arsenate powder, 3 lb. lime in 40 gallons water	80.
6........	1	Oct. 19	1 lb. Electro lead arsenate powder in 40 gallons water	50.
2........	2	Oct. 19; Nov. 2	1 lb. Electro lead arsenate powder in 40 gallons water	90.
8........	1	Oct. 19	1 lb. Capex lead arsenate powder in 40 gallons water	65.†
8........	1	Oct. 19	1¼ lb. California neutral lead arsenate powder in 40 gallons water	2 per cent., only on side exposed to hot wind. Not defoliated. Burning, slight.
8........	2	Oct. 19; Nov. 2	1¼ lb. California neutral lead arsenate powder in 40 gallons water	5 per cent., only on side exposed to hot wind. Not defoliated. Burning, slight.

* Two of these trees were much less burned than the others.
† Three trees had 50 per cent. spray burn.

TABLE 15.

*Developed and Undeveloped Infestations ("Stings") in Royal Apricots.**

Date of Egg Hatching.	Number of Eggs Hatched.	Number of Developed Infestations.	Number of Undeveloped Infestations.	Total Infestations.
October 18	3	0	6	6
" 18	5	1	7	8
" 18	2	0	2	2
" 19	3	0	6	6
" 19	3	2	2	4
" 19	4	0	6	6
" 21	5	2	3	5
" 21	3	2	4	6
November 5	4	0	3	3
" 5	5	2	4	6
" 6	1	1	0	1
" 6	5	3	1	4
" 6	1	0	2	2
" 7	4	2	2	4
" 7	7	1	7	8
" 7	3	1	2	3
October 17	4	2	7	9
" 17	3	0	4	4
" 18	2	0	4	4
" 18	7	2	15	17
" 18	9	6	6	12
" 18	3	2	7	9
" 18	10	3	13	16
" 18	5	0	10	10
" 19	6	2	8	10
" 19	7	1	12	13
" 19	8	1	11	12
November 4	2	1	2	3
TOTAL	124	37	156	193

* Larvae just hatched were placed on fruits enclosed in muslin bags on the trees. About 5 fruits were enclosed in each bag and one larva was placed on each fruit.

THE SHEEP KED
(*Melophagus ovinus* Linné).

By G. A. H. BEDFORD, F.E.S., Research Officer, Division of Veterinary Education and Research.

THE Sheep Ked is a parasite of sheep living in the wool and on the skin of its host and obtaining nourishment by piercing its host's skin with its proboscis and sucking its blood. It is not able to live on other animals, being entirely dependent upon sheep for its existence. It is a common parasite in South Africa, Europe, America, and Australia. Sheep that are only slightly infected with keds do not appear to be affected to any extent, but when their parasites become numerous, they rapidly fall off in condition and remain in poor condition until they have been dipped and the keds killed.

The ked has been a serious pest in parts of the Cape Province and Orange Free State for some years, and, according to reports, appears to be on the increase. It is only recently, however, that it has become a serious pest in the central Transvaal. Only a few years ago keds were never seen in the Pretoria District, except on sheep imported either from the Cape or Orange Free State, and these animals always became free of keds in a short period without treatment, the keds apparently being killed by the sudden change of meteorological conditions. The fact that keds are now able to live and thrive in the central Transvaal may be due either to their having gradually worked their way north from the south, in which case they would have become acclimatized by degrees, or to their having been imported on sheep at a time when the climatic and atmospheric conditions in the north and south were more or less similar. The same phenomenon has also been observed in the case of the spinose ear tick (*Ornithodorus megnini* Dugès). This tick has been a grave pest in parts of the Cape and Orange Free State for some years, and in 1916 the writer collected a number of specimens in the Cape and attempted to breed them at Onderstepoort under natural conditions for research purposes, but the ticks died in a very short period. Within the last year or so this tick was found living and breeding here, and no doubt would have thrived had not measures been taken to eradicate it.

DESCRIPTION OF THE VARIOUS STAGES.

The *adult* (fig. 1) may be described as a blood-sucking, wingless fly, 4 to 6 mm. (about ¼ inch) in length, the females being usually slightly larger than the males; it is more or less covered with short hairs, and is divided into three distinct parts: the head, thorax, and abdomen. The head is more or less flat, brown in colour, and situated on each side is a compound eye; projecting in front of the head is the proboscis. The thorax is also more or less flat and brown in colour, and attached to it are the legs (three pairs), which are of

the same colour, each being provided with a pair of strong, black claws. The abdomen is usually of a dirty pale-yellow colour, sometimes reddish in the middle in gorged specimens.

The *larva,* which is headless and legless and incapable of movement, is elongated oval, white in colour; length 4 mm.

The *pupa* (fig. 2) resembles the larva, the only difference being that the membrane is hard and of a brown or dark brown colour.

THE LIFE-HISTORY.

The life-cycle has been studied in America, Australia, and also, to a certain extent, in this country, and it appears to be practically the same in all these countries.

The ked is practically full grown when it leaves the pupal case, and shortly after hatching, commences to have a feed on its host. Three to four days later copulation may take place. The females do not lay eggs, these hatching and the larvae developing within

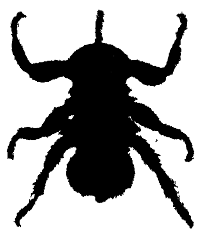

FIG. 1.—Adult Sheep Ked (*Melophagus ovinus*) × 4.

FIG. 2.—Pupae of the Sheep Ked × 4.

their bodies. The females usually deposit their first larva about thirteen to twenty-four days after emerging from the pupal case, but they have been known to take as long as thirty days in America (1). The full grown larvae on being deposited are attached to the wool of the sheep by means of a glue-like substance, and these change into pupae within about twelve hours. The pupal stage usually lasts nineteen to twenty-three days in summer and about twenty-three to twenty-six days in winter. As the duration of the pupal stage varies according to the temperature, it is possible that it may last a few days longer during the winter months, when sheep are kept either on the high veld or on mountain slopes. The average life of a female is about four to five months, five and a half months being the longest period a female has been kept alive under observation (1). The females deposit larvae on an average of one every ten to twelve days after giving birth to the first larva and the total number a female will deposit being up to twelve to fifteen.

MODE OF INFECTION AND LENGTH OF TIME KEDS CAN LIVE OFF THEIR HOSTS.

The usual mode of infection is by contact. Swingle (1) has recorded a case of a sheep free from keds having been kept for months beside a heavily infected one, with only a partition 3 feet high between them, without becoming infected.

Keds, being permanent parasites and dependent upon sheep for their existence, are not able to live off their hosts for any great length of time. If a number of keds are kept off their hosts, it will be found that they commence to die in a day or two, and that the majority will die within about four to six days. The pupae can hatch off their hosts provided the temperature is suitable for them. As a rule the period of hatching is about the same as on the host. Young adult keds on hatching from the pupal cases are always very weak until they have had a feed, and, should they hatch or drop off an animal, are therefore less likely to succeed in getting on to a host than one that has previously fed. The longest time we have succeeded in keeping a freshly hatched ked alive off a host is twelve days, and the longest period an engorged ked has been kept alive off a host is eighteen days (2).

Cool weather is more beneficial to keds than hot weather; this not only applies to keds off their hosts but also to keds on their hosts.

SYMPTOMS.

The presence of keds on sheep may be suspected when the animals either scratch, bite, or rub themselves, and when, as a result, they show a ragged fleece. As scab, lice, ticks, and grass and other seeds also cause sheep to scratch, rub, and bite themselves, the only way to find out whether they are infected or not is to examine them for the parasites. Keds and pupae are usually most numerous on the sides of the bodies and base of the legs of their hosts and are as a rule easily detected on parting the wool.

HARMFUL EFFECTS KEDS HAVE UPON THEIR HOSTS.

The damage keds do to their hosts are twofold—

(1) They cause loss of blood, great irritation, interference with feeding, with the result that the animals fall off in condition and become weak;

(2) They deteriorate the wool, not only by soiling it, but also by causing the sheep to rub, bite, and scratch themselves and by lowering the general vitality of the animals.

KEDS ARE TRANSMITTERS OF DISEASE.

Nöller (3) has demonstrated in Germany that the sheep trypanosome (*Trypanosoma melophagi*) can be transmitted by the ked. Fortunately, this trypanosome is non-pathogenic to sheep.

PREVENTION.

It is very improbable that clean sheep will become infected when grazing on veld previously grazed over by infected animals, but if

clean sheep are placed either in a kraal or small area previously occupied by infected sheep they are much more liable to infection. The smaller the area and the shorter the interval the area is kept free of sheep, the greater the risk. We would recommend the farmer to take no risks, and to keep all clean sheep away from infected places for forty to sixty days. This, unfortunately may not always be practicable. If infected kraals must be used for clean sheep, either the ground or manure on the surface should be removed or some brushwood scattered in the kraal and burned beforehand.

On no account should clean sheep be allowed to come in contact with infected animals.

Persons handling infected sheep very frequently get keds on their clothing, and may, if no care is taken, transport them from one flock to another, especially at shearing time. Keds are easily seen, and all that is necessary is for such persons to examine their clothing and bodies. Keds frequently bite man, but they are not able to live on him for more than a day or two.

TREATMENT.

There is only one treatment for keds, and that is dipping.

Dips.—Dipping experiments were recently carried out at Onderstepoort to ascertain the effect of the following dips upon keds:—

(1) Lime and sulphur (Capex).
(2) Lime and sulphur (Capex) plus arsenic (1 lb. per 100 gallons).
(3) Nicotine—McDougall's "Lion Brand" concentrated.
(4) Cooper's Sheep Dipping Powder.
(5) McDougall's Powder Dip.
(6) Carbolic—Little's Fluid.

Ten long-woolled sheep (very badly infected) were used for each test; five receiving two dippings at 14 days' interval and five receiving three dippings at 10 and 24 days' interval, i.e. 24 days after the first dipping, with the exception of those dipped in Little's Fluid, which only received a single immersion owing to the weather being unfavourable, and also those dipped in Cooper's, which were only given two dippings at 9 days' interval. All the animals were immersed for two minutes at each dipping.

RESULTS.

(1) *Lime and Sulphur (Capex).*

This dipping fluid appeared to have no effect upon the keds for the first few days after the first dipping. On the sixth day after dipping, the keds were still very numerous, only a few dead ones being found. Thirteen days after the second dipping at 10 days' interval, only one live ked could be found on one of the sheep, and on the ninth day after the second dipping at 14 days' interval, five live keds were found on two of the animals; these had probably hatched a day or two beforehand. Finally, all the sheep were found to be free of keds.

(2) *Lime and Sulphur (Capex) plus Arsenic.*

The results with this fluid were practically the same, except that the keds commenced dying sooner after the first dipping. On the second day after dipping, only a few live keds could be found on the

animals, except on one sheep, on which they were fairly numerous. No live keds were found on the sheep after they had been given two immersions, and they finally became free of keds.

(3) *Nicotine—McDougall's "Lion Brand" concentrated.*

No live keds could be found on the sheep twenty-four hours after the first dipping. Six days after the second dipping at 14 days' interval, two live keds were found on one of the animals and one on another; these hatched from pupae after dipping. Infection finally became re-established on both these animals, but not on any of the others that were given either two or three immersions.

(4) *Cooper's Sheep Dipping Powder.*

No live, fully-developed keds were found on the sheep twenty-four hours to six months after the first dipping.

(5) *McDougall's Powder Dip.*

No live, fully-developed keds were found on the sheep twenty-four hours to six months after the first dipping.

(6) *Carbolic Dip—Little's Fluid.*

No live keds were found on the sheep twenty-four hours to six months after they had been given a single immersion.

The Effect of the above Dipping Fluids upon the Pupae.

It was observed in the above dipping trials that the sheep lost a larger number of pupae in the dipping-tank when they were given the first and second immersions, the pupae being washed out of the wool. In one case considerably more than 150 pupae were collected in the tank after ten sheep had been given their first immersion, and in the other tests the number of pupae seen in the tank after the first dipping was about the same. However, the majority of the animals retained a number of pupae, and a few pupae were found on most of the sheep after they had been given three immersions. After dipping, a number of pupae were collected on the sheep and kept under observation on marked patches on the same animals. In most instances some of the pupae hatched, the keds usually emerging within a few days after the pupae were collected. Whether the dippings were responsible for some of the pupae not hatching, it is, of course, impossible to state. It was observed that the few keds that hatched from the marked pupae were always killed by the dipping fluids that remained in the fleeces of the animals. In some cases freshly-hatched keds were found on some of the sheep at various periods after dipping, but these also only lived a day or two, except in the case of those found on two sheep dipped in tobacco.

CONCLUSIONS.

As the above experiments were carried out on a small scale and were therefore only preliminary tests, too much importance must not be attached to them. Had the dips been tested with sheep possessing thicker fleeces it is possible that the results would have been different, as probably considerably less pupae would have been washed out when the animals were dipped.

The lime and sulphur dip is, owing to its very slow action on the keds, not a dip to be recommended for use against these insects, nor would we advise the use of a tobacco dip. As a rule, a dip containing arsenic, such as Cooper's, is advocated.

NUMBER OF DIPPINGS AND INTERVALS BETWEEN DIPPINGS.

It is strongly recommended that sheep infected with keds be given three dippings. We are perfectly aware that many farmers will object to giving their sheep three consecutive dippings, and no doubt many will hold the view that only two dippings are necessary, especially as it has been shown that sheep can be cured of keds with only one or two dippings. Three immersions must be given if keds are to be eradicated owing to their pupae not always being destroyed by the fluids and the length of time they take to hatch. If only two dippings were necessary, many flocks of sheep that are infected with keds to-day would be free. Moreover, scab was eradicated in Australia with two dippings, yet the ked is a common parasite in that country to-day. We would impress on the farmer that if he wishes to improve the condition of his flocks and save himself the trouble and expense of dipping annually, he must eradicate keds, and to do that he must run no risks and dip properly. It is useless to go on breeding keds and at the same time play at eradicating them. If dipping operations are carried out properly, three dippings will not harm the sheep. We have always found that the first dipping is the most harmful to sheep, but the harmful effects are only temporary. Once a sheep badly infected with either keds or scab has been dipped and freed of most or all its parasites, it will improve rapidly in condition.

For keds it is recommended that the second and third dippings be given at intervals of fourteen days, but as it is usually advisable to dip for scab at the same time, thereby "killing two bugs with one dip," it is advocated that the second dipping be given nine to ten days and the third twenty-four days after the first dipping.

DIPPING RULES THAT SHOULD BE STRICTLY ADHERED TO.

1. If a flock of sheep is only slightly infected with keds, especially when shearing operations are carried out, the animals should not be left until they become badly infected before they are dipped. Farmers have informed us that their flocks were infected with keds, but as the parasites were not numerous and were doing little or no harm to the sheep, they did not bother to dip. That, however, is the wrong policy. It is true the ked is a very slow breeder, especially compared with the majority of other insects and parasitic mites, and does little harm to its host unless it is numerous, but that is no reason why the farmer should not attempt to eradicate it. If farmers ignore a pest and take no steps to eradicate it when it is scarce, that pest will *never* be eradicated. It is easier to eradicate a pest when it is scarce than when it becomes a plague.

2. When dipping a flock of sheep for either keds or scab it is *very* important to see that *every* sheep in the flock is properly dipped. Should it not be possible to dip one or more sheep owing to the animals being in ill-health or for some other reason, such animals

must be isolated from the flock and kept apart until such time as it has been found possible to rid them of parasites by dipping.

3. Dipping operations are best carried out after shearing, the sooner the better, but all cuts and wounds must be allowed to heal first. Why dipping is recommended after shearing is because in shearing, the sheep are freed of a large number of keds and, what is more important, all, or practically all, their pupae, and the shorter the interval between shearing and dipping, the less pupae there will be in the wool.

4. After shearing, the sheep should be kept away from the place where the operation is performed. This will prevent any of the keds removed with the wool getting on to a sheep again.

5. The dip should be properly mixed before being poured into the tank, and the right amount of water must be added.

6. The sheep should be kept in the dipping-tank a full two minutes, during which time they should have their heads immersed two or three times.

7. The period the sheep are in the tank should be timed either with a two-minute sandglass or a stop-watch.

8. After dipping, the sheep should be kept in a draining enclosure before being turned out to graze, otherwise the fluid will drip from the animals on to the grass and may produce fatal results should a poisonous dip be used.

9. Sheep should not be kept in infected kraals or on infected ground after dipping.

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LUCERNE: CO-OPERATIVE MANURIAL EXPERIMENTS.*

By T. G. W. REINECKE, B.A., M.Sc.,
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PREFACE.

THE experiments with lucerne fertilization conducted by Mr. T. G. W. Reinecke at Gerardminnebron and Haaskraal, and recorded below, are the most thorough of which there is any record in South Africa.

When Mr. Reinecke left here ten years ago, I took his place, and have based nearly all my advice on lucerne fertilizing on the results of those experiments. The farmers who have put the advice into practice have benefited financially, and have put in most satisfactory reports. The main points of Mr. Reinecke's three year results on each of the two above-mentioned locations can be briefly summarized in the following manner:—

1. Superphosphate was by far the most profitable of the various phosphates tested.
2. There was a progressive geometrical increase in profits per acre when using dressings of 200, 300, and 400 lb. of superphosphate; i.e. the money invested in 400-lb. dressings gave a far higher interest than that invested in 200 lb. and 300 lb.
3. In both experiments 400 lb. per acre applied in August, before growth had started, and either before or after the first irrigation, was much more profitable than applying two dressings each of 200 lb., one in August and one after the second cutting.
4. Kraal manure gave good results in both experiments, and when valued at 5s. per ton was very profitable. The 12 ton per acre dressing, however, was far more profitable than the 8 ton one.
5. Superphosphate and muriate of potash gave higher yields than super alone, but the profits from super alone were always higher.

As regards the amount of superphosphate to be used, practical experience in this, the largest lucerne district in the Transvaal, has tended to increase the 400-lb. dressing of superphosphate to 500 lb. per acre, rather than decrease it. Several farmers have told me they find the 500-lb. dressing per year is more profitable than the 400-lb. one.

RECENT INVESTIGATIONS.

1. *Potash*.—Keeping in mind the fact that lucerne removes large quantities of potash from the soil, eleven farmers were supplied with muriate of potash in the 1924-25 season in order to see if this fertilizer at the rate of 100 lb. per acre would not give an increased yield over superphosphate alone. Not one of the participants in this co-operative experiment reported any increased yield from the use of

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potash. Farmers on less fertile soils than those of the lucerne area of the Mooi River Valley, Potchefstroom, are advised to satisfy themselves on this point by a small experiment which will cost them little, but which may either save them from the extra cost of buying mixed lucerne fertilizer, or be the cause of greater profits by indicating that potash is necessary.

2. *Lime.*—As there is much lime in both the lucerne soils and in the irrigation water of this area, no further investigations have been carried out with regard to this substance. In areas, however, where soil and water are both deficient in lime, dressings of 500 lb. to 1,500 lb. per acre of limestone, ground to pass a ¼ inch mesh, will be found to be profitable. Those amounts may be applied every second or third year, depending on the nature of the soil. On sandy loams the lime is dissolved out more quickly than on loams and clay loams.

3. *Phosphates.*—In the 1924-25 season, I conducted a plot experiment on a local farmer's lucerne. The land had, however, been apparently too well manured previously to give many significant differences from various treatments in that one season, and the owner would not let me run the experiment for another year. There were a few significant results however.

(*a*) Superphosphate was tried at the rates of 300 lb. and 600 lb. per acre, and the higher dressing consistently gave the greater yield and also the greater profits.

(*b*) The following rock phosphates were tried without any beneficial results; viz., Christmas Island, Egyptian, Ephos Basic Phosphate, and Langebaan.

4. *Sulphur and Phosphates.*—A dressing of 300 lb. per acre of Christmas Island rock phosphates and 200 lb. per acre of sulphur gave nearly as good a yield as 600 lb. of superphosphate. Sulphur alone also showed up quite well. These plots were added to confirm my opinion that the reason why superphosphate shows up so well over other phosphates is not due alone to its solubility in water, but to the fact that it supplies two necessary elements for mineral nutrition in an easily available form, whereas the others supply chiefly less available phosphates. These results appear to confirm my opinion, but I am carrying out similar experiments with sulphur and rock phosphate as compared with superphosphate at three other centres, to try and establish this opinion more securely. In Oregon, on soils where there is evidently a marked sulphur deficiency, sulphur alone has given as good lucerne yields as superphosphate, and the benefits from the superphosphates are ascribed solely to the sulphur it contains in the form of sulphate of lime.

5. *Phosphates and Potash.*—More than half the various mixtures in the twenty-eight plots contained potash, but there was no conclusive evidence of any benefit from the addition of muriate of potash.

DAMAGE TO GERMINATION BY SUPERPHOSPHATE.

It was reported that a number of people had suffered by using 400 lb. per acre of superphosphates in establishing lucerne. It was told us that the super had caused poor germination. In all cases investigated *in situ*, however, it was found that the poor stand was

obtained where there was rather too steep a slope, or where too strong a stream of water was used, resulting in the washing away of the seed. My assistant, Dr. J. J. Theron, at my suggestion planted lucerne seed in soil containing up to 1,000 lb. per acre of superphosphates, and there was not the slightest damage to germination. This charge appears then to be groundless.

FERTILIZING TO ESTABLISH LUCERNE.

In the Transvaal some of the most successful stands of lucerne are those that have been planted in March, when there was sufficient rainfall to cause germination and growth without resort to irrigation, until the crop was well rooted. Experienced irrigation farmers can, however, establish good crops in April, May, and June, and even up to August, though in the last month there is likely to be trouble with weeds. Land which is to be seeded to lucerne in the autumn should have had a dressing of 12 to 20 tons per acre of kraal manure, and should have been ploughed and disked or harrowed on two or three occasions to get rid of all weeds. A dressing of 400 to 500 lb. per acre of a mixture of two parts of superphosphate and one part of rock phosphate will also be of the greatest assistance in getting a deeply-rooted and well-established stand. When the phosphate dressing is applied it is best ploughed under with the kraal manure. Land treated in this manner should not require fertilization again for 1½ to 2½ years. Some farmers prefer to apply the kraal manure alone in the autumn, and to apply the phosphates the following August, or even the August the following year. Whether there is any advantage in this method, I cannot say, as there are no data on which to base opinions. It must be remembered, however, that phosphates greatly stimulate root growth, and a strong healthy root system at the start is a great advantage. If it is a case of not wanting to put so much money into fertilizers, I would suggest just a light dressing of phosphates at the rate of 100 lb. per acre, and then a good dressing in the August of the following year.

INOCULATIONS OF LUCERNE SEED.

In most cases that have come to my notice, it has not been found at all necessary or profitable to inoculate the lucerne seed previous to planting. The only soils on which I am convinced it is necessary to inoculate lucerne when being planted for the first time are the granitic soils of the middle and low veld. There are places in those areas, however, where lucerne, even if inoculated, fertilized, and limed in the most complete way, is not likely to succeed, due to high rainfall and humidity, which make it susceptible to disease under such conditions. There are still many questions with regard to lucerne fertilization which cannot be answered with any degree of certainty, but most of these it is hoped will be investigated shortly. Farmers, however, who base their practice on Mr. Reinecke's results in conjunction with the later information supplied in this preface can rest assured that, as far as fertilization is concerned, they have done their best for their lucerne crop.

T. D. HALL,
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MR. REINECKE'S EXPERIMENTS.

The results below are from two series of manurial trials which were carried out by the writer for three seasons on two farms along the Mooi River—one at Gerard Minnebron, near Frederikstad Station, occupied by Messrs. Kriegler and Retief, and the other at Haaskraal, then occupied by Mr. W. Gush, situated south of Potchefstroom town.

The soil in Experiment I at Gerard Minnebron, a black clay loam, is of the two the most typical of the ground under lucerne both north and south of the town. The soil in Experiment II, a brown sandy loam, has been observed more south of the town.

In the October number of the *Union Agricultural Journal* of 1912 the first season's results of these experiments were reported. The results of seasons 1912-13 and 1913-14, along with those of the first year 1911-12 referred to, are appended hereto, as well as the percentage of the important soil constituents as shown by analyses of the respective types of soil.

TABLE I.

ANALYSIS OF GERARD MINNEBRON SOIL.

	Black Clay Loam Percentage.
Lime	·928
Carbonate of lime	·272
Potash	·476
"Available" potash	·011
Phosphoric acid	·088
"Available" phosphoric acid	·00383
Loss on ignition	8·560
Nitrogen	·198

TABLE II.

ANALYSIS OF HAASKRAAL SOIL.

	Brown Light Loam. Percentage
Lime	·415
Carbonate of lime	·250
Potash	·450
"Available" potash	·0240
Phosphoric acid	·0820
"Available" phosphoric acid	·00380
Loss on ignition	1·070
Nitrogen	·0902

The soils show, according to accepted standards, a sufficiency of both "available" potash as well as "total" or "reserve" potash, and for their respective types a sufficiency of lime. In this last respect it should be noted that in both soils there is a fair amount of lime present in the form of carbonate of lime. The analyses would seem to indicate that neither of the two soils requires treatment with either lime or potash. This the experiments have actually proved. For, although in the third year, 1913-14, of the Haaskraal experiment (see below) either potash or lime in conjunction with superphosphate showed an increase, as against a plot receiving superphosphate alone, this was due to the fact that the yield of the superphosphate plot was largely controlled by the lack of moisture in this season, and its returns are considerably lower than what may have been expected in a normal year.

That the returns of plot 6 (400 lb. superphosphate per acre) in season 1913-14 are too low, can be seen by comparing them with the returns of plot 5, which received 100 lb. superphosphate less per acre annually, and those of plot 9 (see note) which only received 200 lb. superphosphate in this season.

The respective returns in hay per acre of plots 5 and 6 for the last two cuttings in season 1913-14 are:—

	3rd Cutting.	4th Cutting.
Plot No. 5	2,000 lb.	1,260 lb.
Plot No. 6	2,016 lb.	1,016 lb.

This illustrates to what extent the returns of plot 6 were affected by the scarcity of water.

The analyses would indicate, according to our accepted standards, a deficiency in both soils of total as well as available phosphoric acid. The experiments have confirmed this.

In connexion with the tables that follow, it should be noted that the lucerne was cut at the usual time and weighed immediately. One-fifth of this weight was taken to represent the weight of hay in all cases.

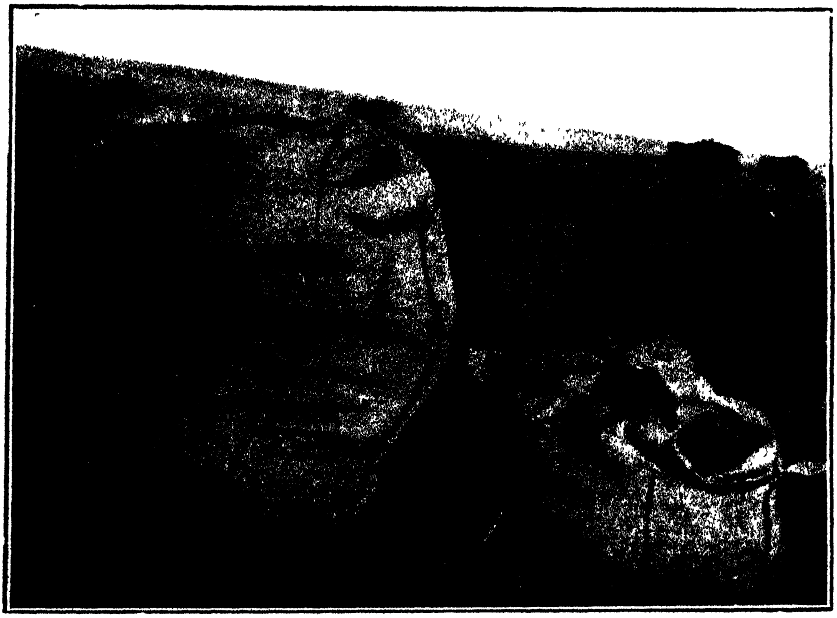


Plate I.

Shows the returns of plot 6 (400 lb. superphosphate per acre) on left and plot 7 (no manure) on right in the Haaskraal experiment for the first cutting of season 1912-13. The cutting, being the first of the season, was a very light one.

Experiments were done in the field to determine the amount of hay obtained from 100 lb. freshly cut lucerne. About 500 lb. of this material was cured in exactly the same way as the farmer's main crop, then baled and weighed. The amount of hay obtained from 100 lb. freshly cut lucerne was:—

1st, 18 lb.; 2nd, 23 lb.; 3rd, 23 lb.; 4th, 25 lb.; these being the results of four separate lots determined at three different times of the year (No. 1 determination was done in April).

The amount of hay obtained from freshly cut lucerne would seem to vary according to the time of year.

The following Tables III and IV show the average yields and profits per acre for the more important plots.

TABLE III.

EXPERIMENT I.—GERARD MINNEBRON.

Results for Seasons 1911-12, 1912-13, 1913-14.

Plot No.	Manurial Treatment per Acre per Annum.	Yield in lb. Hay per Acre. 1st Year. 5 Cuttings.	2nd Year. 6 Cuttings.	3rd Year. 5 Cuttings.	Average Yield per Acre per Annum for 3 Years.	Increase in lb. Hay per Acre due to Manuring. 1st Year.	2nd Year.	3rd Year.	Value of Increase at 4s. per 100 lb. Hay. 1st Year.	2nd Year.	3rd Year.	Cost of Manure per Acre per Annum.	Profit per Acre due to Manuring. 1st Year.	2nd Year.	3rd Year.	Average Profit per Acre for 3 Years.
									£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	No manure....................	4,512	3,540	2,112	3,388	—	—	--	—	—	—	—	—	—	—	—
2	Superphosphate...........200 lb.	6,892	6,712	4,668	6,090	1,774	2,884	2,510	3 11 0	5 15 4	5 0 5	0 11 2	2 19 10	5 4 2	4 9 3	4 4 5
3	Superphosphate...........300 lb.	8,474	7,560	5,872	7,302	3,356	3,732	3,714	6 14 3	7 9 3	7 8 7	0 16 9	5 17 6	6 12 6	6 11 10	6 7 3
4	Superphosphate...........400 lb.	9,320	8,912	7,176	8,469	4,202	5,084	5,018	8 8 1	10 3 4	10 0 9	1 2 4	7 5 9	9 1 0	8 18 5	8 8 4
5	Superphosphate..........400 lb. *Potash.................100 lb.	9,420	9,132	7,728	8,760	4,303	5,304	5,570	8 12 1	10 12 2	11 2 10	1 17 1	6 15 0	8 15 1	9 5 9	8 5 3
6	Superphosphate..........400 lb. †Lime...................1,000 lb.	8,724	9,068	7,358	8,383	3,605	5,240	5,200	7 4 2	10 9 7	10 8 0	1 15 5	5 8 9	8 14 2	8 12 7	7 11 10
7	Superphosphate..........400 lb. *Potash.................100 lb. †Lime.................1,000 lb.	8,668	8,936	7,564	8,389	3,550	5,108	5,406	7 2 0	10 4 4	10 16 3	2 10 2	4 11 10	7 14 2	8 6 1	6 17 4
8	‡Kraal manure...........12 tons	10,892	11,196	9,364	10,484	5,774	7,368	7,206	11 11 0	14 14 9	14 8 3	3 0 0	8 11 0	11 14 9	11 8 3	10 11 4
9	Basic slag...............200 lb.	7,012	6,316	4,536	5,934	1,894	2,488	2,378	3 15 9	4 19 7	4 15 1	0 11 6	3 4 3	4 8 1	4 3 7	3 18 8
10	Basic slag...............300 lb.	6,972	6,324	4,628	5,974	1,854	2,496	2,470	3 14 2	4 19 10	4 18 10	0 17 3	2 16 11	4 2 7	4 1 7	3 13 8
11	Basic slag...............400 lb.	6,976	6,306	4,628	5,970	1,858	2,478	2,470	3 14 4	4 19 1	4 18 10	1 3 0	2 11 4	3 16 1	3 15 10	3 7 9
12	Superphosphate...........200 lb. And after 2nd cutting..200 lb.	8,256	8,484	6,496	7,745	3,138	4,656	4,338	6 5 6	9 6 3	8 13 6	1 2 4	5 3 2	8 3 11	7 11 2	6 19 5
13	Steamed bone flour.......400 lb.	6,164	5,564	4,144	5,290	1,046	1,736	1,986	2 1 10	3 9 5	3 19 5	1 9 8	0 12 2	1 19 9	2 9 9	1 13 11
14	No manure....................	5,724	4,116	2,204	4,014	—	—	—	—	—	—	—	—	—	—	—
15	‡Kraal manure...........8 tons §Superphosphate.........200 lb.	9,067	9,988	8,424	9,159	3,949	6,160	6,266	7 18 0	12 6 5	12 10 8	2 11 2	5 6 10	9 15 3	9 19 6	8 7 2
16	Kraal manure...........8 tons	8,764	8,664	6,792	8,073	3,646	4,836	4,634	7 5 10	9 13 5	9 5 4	2 0 0	5 5 10	7 13 5	7 5 4	6 14 10

Average of "No Manure" plots taken in each year to calculate the "Increase due to Manuring."
* By potash is meant muriate of potash in the first and second years and sulphate of potash in the third year.
† Lime in the first year was air-slaked lime and in the second and third years was ground limestone.
‡ Kraal manure in the first year was dry concentrated sheep's dung, and in the second and third years cattle dung from kraals.
§ Superphosphate in this plot only applied after second cutting in December of the first year. In the second and third years it was applied along with the kraal manure at the beginning of the season.
NOTE.—Plot No. 16 in this experiment corresponds to Plot No. 15 in the pamphlet No. 61 of 1912.

TABLE IV.

EXPERIMENT II.—HAASKRAAL.

Results for Seasons 1911-12, 1912-13, 1913-14.

Plot No.	Manurial Treatment per Acre per Annum.	Yield in lb. Hay per Acre. 1st Year. 5 Cuttings.	2nd Year. 6 Cuttings.	3rd Year. 4 Cuttings.	Average Yield per First 2 Years. 1911–12. 1912–13.	Increase in lb. Hay per Acre due to Manuring. 1st Year.	2nd Year.	3rd Year.	Value of Increase at 4s. per 100 lb. Hay. 1st Year.	2nd Year.	3rd Year.	Cost of Manure per Acre per Annum.	Profit per Acre due to Manuring. 1st Year.	2nd Year.	3rd Year.	Average Profit First 2 Years. 1911–12. 1912–13.
									£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	Basic slag..............200 lb.	4,776	7,048	4,748	5.912	138	2,642	1,708	0 5 6	5 5 8	3 8 4	0 11 6	loss 6 –	4 14 2	2 16 10	2 4 1
2	Basic slag..............300 lb.	5,056	6.192	5,044	5,624	418	1.786	2,004	0 16 9	3 11 5	4 0 2	0 17 3	loss 6 –	2 14 2	3 2 11	1 6 10
3	Basic slag..............400 lb.	5,680	6,968	5.340	6.324	1,042	2,562	2,300	2 1 8	5 2 6	4 12 0	1 3 0	0 18 8	3 19 6	3 9 0	2 9 1
4	Superphosphate..........200 lb.	5,496	7,300	5,128	6.398	858	2,894	2,088	1 14 4	5 15 9	4 3 6	0 11 2	1 3 2	5 4 7	3 12 4	3 3 10
5	Superphosphate..........300 lb.	6,156	7,332	5,556	6.744	1,518	2,926	2,816	3 0 9	5 17 0	5 12 8	0 16 9	2 4 0	5 0 3	4 15 11	3 12 1
6	Superphosphate..........400 lb.	7,024	8,984	6,312	8.004	2,386	4,578	3,272	4 15 5	9 3 1	6 10 11	1 2 4	3 13 1	8 0 9	5 8 7	5 16 11
7	No manure..................	4,876	4,568	2,944	4.722	—	—	—	—	—	—	—	—	—	—	—
8	Steamed bone flour.......400 lb.	4,940	4,500	3,944	4,720	302	94	904	0 12 1	0 3 9	1 16 2	1 9 8	loss 17 7	loss 25 11	0 6 6	loss 21 9
9	Superphosphate..........200 lb. *And another 200 lb. after 2nd cutting..................	6,976	8,456	6,448	7,716	2,338	4,050	3,408	4 13 6	8 2 0	6 16 4	1 2 4	3 11 2	6 19 8	5 14 0	5 5 5
10	Superphosphate..........400 lb. †Potash..............100 lb.	7,248	9,458	7,436	8,353	2,610	5,052	4,396	5 4 5	10 2 1	8 15 10	1 17 1	3 7 4	8 5 0	6 18 9	5 16 2
11	Superphosphate..........400 lb. ‡Lime..............1,000 lb.	7,388	9,004	7,576	8.196	2,750	4,598	4,536	5 10 0	9 3 11	9 1 5	1 15 5	3 14 7	7 8 6	7 6 0	5 11 6
12	Superphosphate..........400 lb. †Potash..............100 lb. ‡Lime..............1,000 lb.	7,132	8,576	7,060	7,854	2,494	4,170	4.020	4 19 9	8 6 10	8 0 10	2 10 2	2 9 7	5 16 8	5 10 8	4 3 1
13	No manure..................	4,400	4,244	3,136	4,322	—	—	—	—	—	—	—	—	—	—	—
14	§Kraal manure...........8 tons	5,256	6,692	5,900	5,974	618	2,286	2,860	1 4 9	4 11 5	5 14 5	2 0 0	loss 15/3	2 11 5	3 14 5	0 18 1
15	§Kraal manure...........12 tons	6,484	7,772	6,884	7,128	1,846	3,366	3.844	3 13 10	6 14 8	7 13 9	3 0 0	0 13 10	3 14 8	4 13 9	2 4 3

Average of "No Manure" plots taken each year to calculate "Increase due to Manuring."
* In the third year the additional dressing of superphosphate at the rate of 200 lb. after the second cutting was not given to this plot.
† By "potash" is meant muriate of potash in first and second years and sulphate of potash in third year.
‡ Lime in first year was air-slaked lime and in the second and third years was ground limestone.
§ By "kraal manure" in first year is meant moist horse stable manure. In the second and third years material was obtained from cattle kraals.
N.B.—The results of the third year have been discarded on account of the fact that the returns were affected by the great scarcity of water during the whole season, but especially the second half thereof. The last cutting was not taken at all on this account.

Plate II.

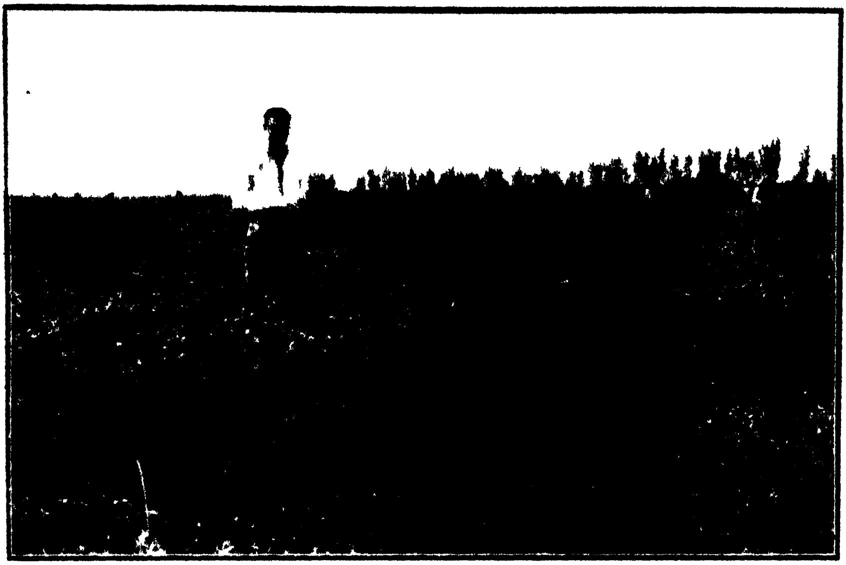


Plate III.

Plates II and III show the stand of lucerne in the above two plots in the order mentioned just prior to the fourth cutting at the end of January in the same season.

EXPERIMENT I.—GERARD MINNEBRON.

AVERAGES FOR THREE YEARS 1911-12, 1912-13, 1913-14.

Figure I: Comparative Yields per Acre.

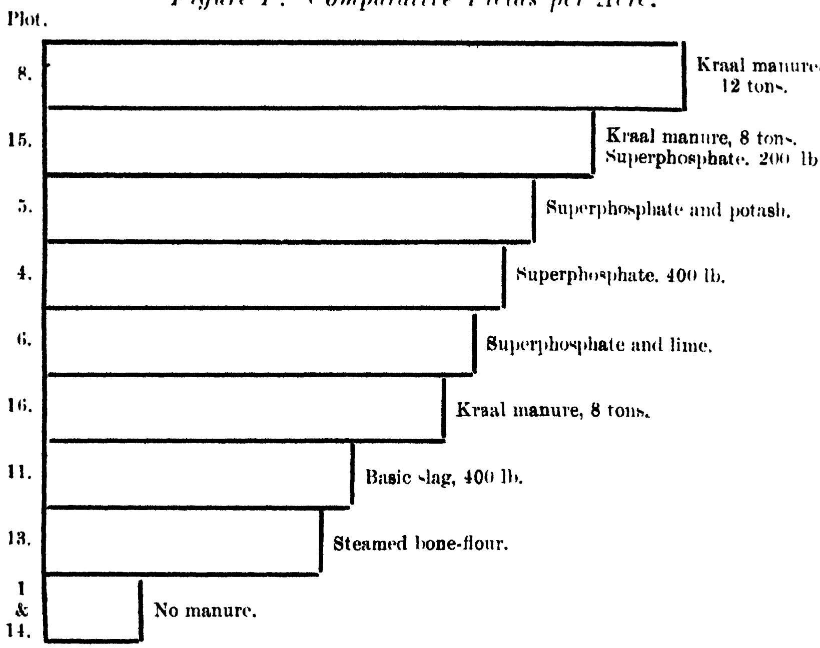
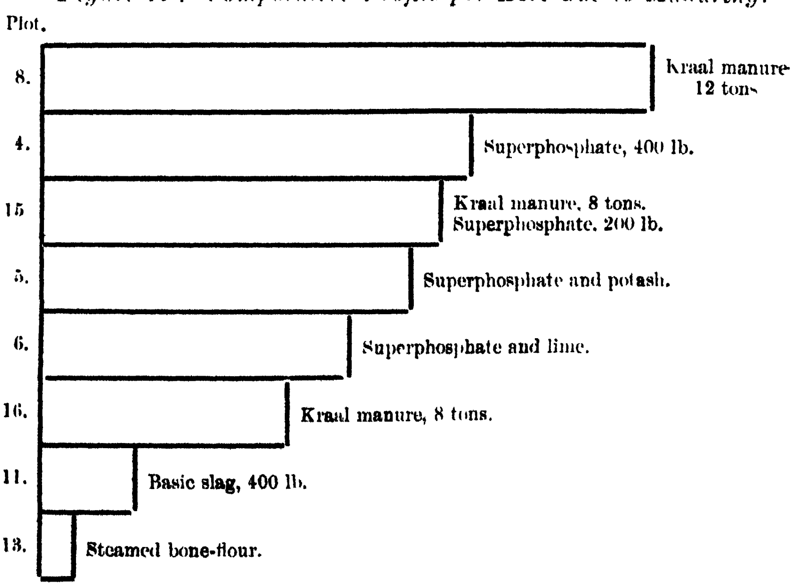


Figure II: Comparative Profits per Acre due to Manuring.



EXPERIMENT II.—HAASKRAAL.

AVERAGES FOR TWO YEARS 1911-12, 1912-13.

Figure III: Comparative Yields per Acre.

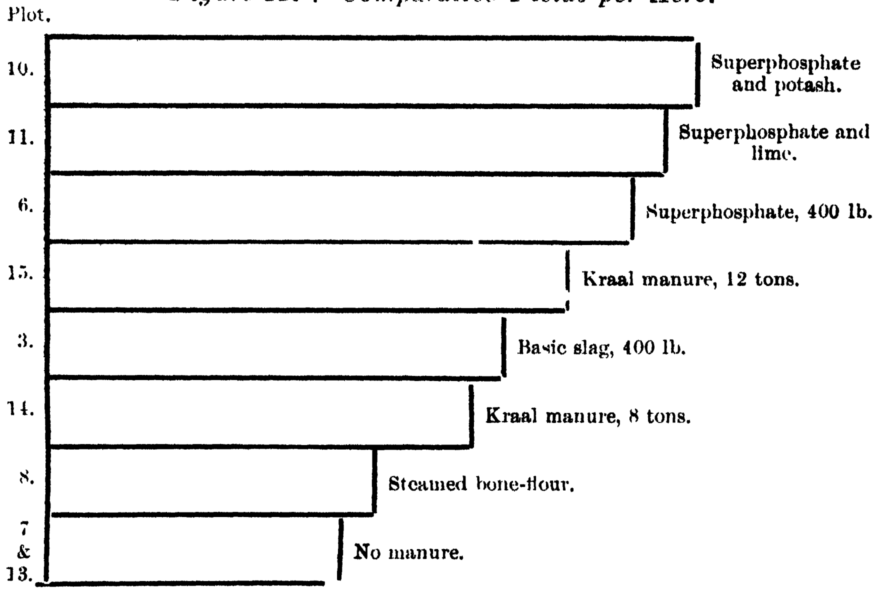
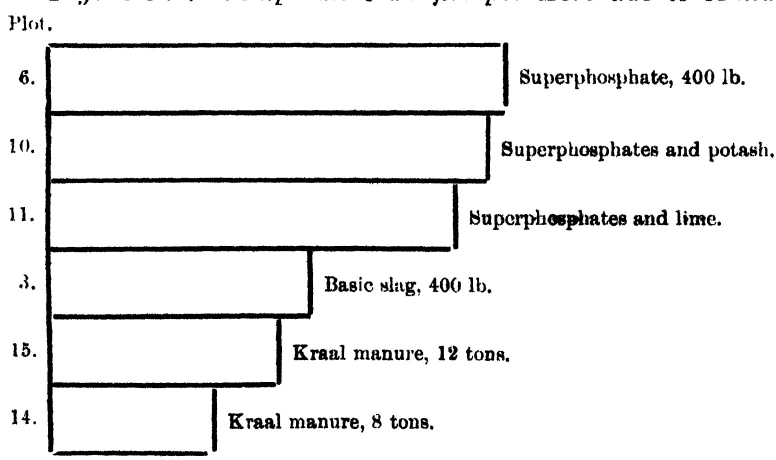


Figure IV: Comparative Profits per Acre due to Manuring.



It can now be seen at a glance from the results of these experiments that in both soils the additional application of potash or lime or both with superphosphate has given no increase in profits. Superphosphate by itself is still the best artificial manure to apply to lucerne on these soils.

The great difference in the action of kraal manure on the two types of soil can be partly explained by the fact that in 1911-12 the kraal manure in Experiment I was dry, powdered sheep's dung and in Experiment II it was wet, horse stable manure with long straw (a material which cannot be termed kraal manure in the accepted sense of this term). The former was certainly three to four times as concentrated as the latter. Farmers generally do not apply such big dressings of sheep's dung as they are afraid it may burn the crop. Even in 1912-13 the cattle dung used in Experiment I was drier than

Plate IV.

that used in Experiment II. It was only in 1913-14 that the kraal manure in both experiments was of uniform composition. The fact that the manure was analysed only in the last year of the experiment is to be regretted.

It should be further pointed out that owing to the fact that the lucerne in Experiment II was drilled in in rows 4 to 6 inches apart and in Experiment I broadcasted, the application of kraal manure in the former caused a growth of weeds, especially in the beginning of each season, to the detriment of the lucerne plants. This undoubtedly

affected the yields of lucerne-hay as well as its quality. In Experiment II the prevalence of weeds was not observed owing to the denser stand which, with the fertilizer ingredients applied, resulted in a crop vigorous enough to choke out the weeds.

The variation in the composition of kraal manure which, as is known, applies to all farmyard manures makes the valuation accepted throughout in this work, namely, 5s. per ton unsatisfactory. However, for the purpose of these experiments some valuation was necessarily put on the material, and the figure of 5s. was taken as a fair average cost of carting and handling. The assumption is made that

Plate V.

Again the same two plots for the sixth and last cutting in the same season 1912-13 (Plates IV and V).

kraal manure is not a marketable or purchasable commodity, but that sufficient quantities of it can be obtained by farmers from the kraals of neighbours and elsewhere

Farmers who are interested in this subject are advised to substitute in the tables above their own valuation of kraal manure, based on their expenses in obtaining it, in place of the figure accepted here. To assist in such a calculation a list is here given of average profits per acre from plots 8, 15, and 16 in Experiment I. The cost per ton of the material is reckoned at 6s., 7s., 8s., 9s., and 10s. respectively.

Plate VI.

TABLE V.

Cost of Kraal Manure.	Average Profits per Acre.		
Per Ton.	Plot No. 16.	Plot No. 15.	Plot No. 8.
£ s. d.	£ s. d	£ s. d.	£ s. d.
0 6 0	6 6 10	7 19 2	9 19 4
0 7 0	5 18 10	7 11 2	9 7 4
0 8 0	5 10 10	7 3 2	8 15 4
0 9 0	5 2 10	6 15 2	8 3 4
0 10 0	4 14 10	6 7 2	7 11 4

It will thus be seen that the superiority in profits of kraal manure over superphosphate disappears when the former is valued at about 8s. per ton.

The following table will show the value of kraal manure based on the value of the increased yield per ton of manure applied:—

TABLE VI.

Plot No.	Treatment.	Value of Average Annual Increase.	Value of Increase per Ton of Manure.
		£ s. d.	
8	12 tons kraal manure.........	13 11 3	$\frac{£13.\ 11s.\ 3d.}{12} = £1.\ 2s.\ 7d.$
16	8 tons kraal manure..........	8 14 10	$\frac{£8.\ 14s.\ 10d.}{8} = £1.\ 1s.\ 10d.$

If the residual manurial value of kraal manure (see below) is taken into consideration, the above material was not expensive even at 20s. per ton. That kraal manure has such a residual value on lucerne lands is illustrated by the following result. A piece of land the same size as plot 8 and treated in exactly the same way, i.e. in 1911-12 received a dressing of 12 tons of kraal manure per acre, gave in season 1912-13, without any further manuring, an increase over the non-manured plots of 2,972 lb. hay, with a value and net profit per acre of £5. 18s. 10d.

TABLE VII.

THE VALUE OF KRAAL MANURE BASED ON THE VALUE OF INCREASE

Produced thereby in Experiment II.

Plot No.	Treatment.	Value of Average Annual Increase for 3 Years.	Value of Increase per Ton of Manure.
		£ s. d.	£ s. d.
15	12 tons kraal manure...	6 0 5	0 10 0
14	8 tons kraal manure.....	3 16 10	0 9 7

That kraal manure is an excellent fertilizer for lucerne on these Mooi River soils is generlly recognized. The fact that it has a tendency to increase the weeds in some lucerne lands is no great disadvantage, since this apparently only occurs when the stand is thin. Such lucerne lands would be more and more taken in by weeds in practically any circumstances and would require resowing sooner or later.

Whilst kraal manure is considered almost indispensable for crops such as potatoes and other roots when grown in addition to lucerne, its use is advocated for the latter wherever it is not required for the root crop.

A good system of manuring, especially if the supply of kraal manure is limited, is as indicated in plot 15 of Experiment I, namely, an application of both kraal manure and superphosphate. The average

Plate VII.

Plates VI and VII show plot 15 (8 tons of kraal manure and 200 lb. superphosphate per acre) and plot 14 (no manure), in experiment I, at the time of the third cutting in season 1912-13.

profits per acre of the two last years of the trials, viz., 1912-13 and 1913-14, in the case of plot 15 were £9. 17s. 3d., as compared with £11. 11s. 6d. in the case of plot 8 and £8. 19s. 8d. in plot 4.

By a comparison of the returns and profits from the plots which received 400 lb. superphosphate, 400 lb. basic slag, and 400 lb. steamed bone-flour respectively, there is no doubt that superphosphate is the best phosphatic fertilizer for lucerne on these Mooi River soils. This merely confirms the experience and opinion of many farmers.

Whilst steamed bone-flour is presumably the quickest acting phosphate of the unvitriolized bone manures, it is nevertheless too

slow for these soils. Its use is not advocated, unless it be mixed with superphosphate.

Although the profits from the use of basic slag were greater in the second and third years of the trials than in the first year, we have no reason to consider this phosphatic manure a good substitute for superphosphate on these soils.

A dressing of superphosphate at the rate of 400 lb. to the acre has proved, roughly, twice as profitable as a dressing of 200 lb. per acre, and about one and a half times as profitable as a dressing of 300 lb. per acre. It is possible, and highly probable, that larger dressings of this fertilizer will give still better economic returns. The very best crop of lucerne yielding 8 tons of hay per acre per annum will remove 82 lb. phosphoric acid from an acre of ground (according to Dr. Hopkins, of the Illinois College of Agriculture), whereas a dressing of 400 lb. superphosphate per acre adds only 68 lb. of phosphoric acid. The heavier dressings of superphosphate have in addition always produced crops of hay of a better quality, especially for the last cutting of each season, when the hay from the plot which received 200 lb. superphosphate was not as free of weeds as that from the plots which received heavier dressings.

With reference to the profits accruing from the application of superphosphate, it should be remembered that this fertilizer was priced according to the average market cost for the years of the experiments. At the time of writing superphosphate cost exactly £2 more per ton. A dressing of 400 lb. superphosphate per acre would cost £1. 10s. 4d. instead of £1. 2s. 4d. This reduces the profits by 8s. only. It will be seen therefore that superphosphate even at the high price of £7. 11s. 8d. a ton brings in handsome profits.

By a comparison of the returns of plots 4 and 12 in Experiment I, and 6 and 9 in Experiment II, it is apparent that there is no advantage in giving the dressing of the 400 lb. superphosphate in two separate instalments, one at the beginning and the other at the end of the season in place of the customary single dressing of the whole amount at the beginning of the season. This is the best time for its application, and it is recommended to cultivate in the manure as soon as possible after the first irrigation.

SUMMARY.

1. Superphosphate at the rate of 400 lb. per acre has proved the best and most economical artificial manure to use on the lucerne lands of the Mooi River, and the addition of potash to the phosphate, as is found in the commercial lucerne fertilizers, has not proved remunerative.

2. The application of lime to these soils has neither proved necessary nor profitable.

3. Kraal manure is an excellent fertilizer for lucerne, especially if the material can be obtained delivered on the farm at a low cost and in large quantities. It can with advantage be supplemented by superphosphate if its supply is limited.

4. Superphosphate is very much superior to either basic slag or steamed bone-flour, and the material is best applied in one dressing at the beginning of the season, instead of in separate instalments at different periods throughout the season.

5. A dressing of 400 lb. superphosphate per acre is more profitable than smaller dressings.

PACKING DECIDUOUS FRUIT FOR EXPORT.

By RALPH J. BULMER, Chief Government Fruit Inspector.

THE article on the above-mentioned subject, published in the November, 1925, issue of the *Journal of the Department of Agriculture*, is revised hereunder, with the addition of certain names of varieties that during the past number of years have proved themselves suitable for export.

During the season just passed (1925-26), frequent complaints have been received from Europe of the fruit being packed in a slack manner; that is to say, the boxes have not been filled to their full capacity. It is the custom to sell our fruit on the European market, not under our grade marks *extra selected*, *selected*, *choice*, and *graded*, but according to the counts in the individual boxes. I am endeavouring, therefore, in this article to instruct packers as to the maximum numbers of the several grades of fruit that can be placed in the different boxes without damaging the fruit or causing any unnecessary loss of space, this latter point being a very important one, as by putting as much fruit in the boxes as possible the packer can economize in his costs of exporting.

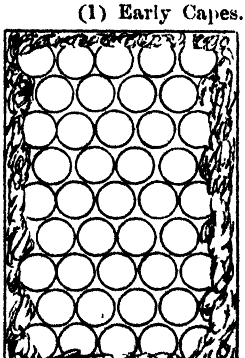
It is strongly recommended that all fruit be packed diagonally. A number of growers use boxes that are too deep for the grade of fruit. This is to be deprecated, as it is not only an extravagant pack, the box not being filled to its full capacity, but causes extra expense in the export costs.

APRICOTS.

In this fruit there are two classes in so far as style of packing is concerned, viz., Early Capes and other varieties. I strongly recommend that only highly coloured fruits of Early Capes should be packed, as unattractive fruit is of no market value. Packing for Early Capes is as follows:—Extra selected, 1⅞, 41 fruits, 9 rows

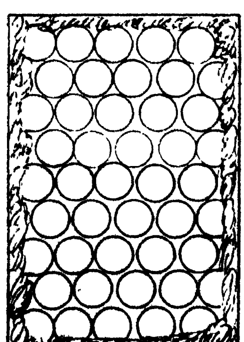
APRICOTS.

Extra Selected.
(1) Early Capes.



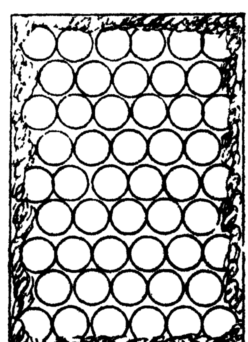
9 5 × 4 = 41.

Selected.



9—5 × 5 = 45.

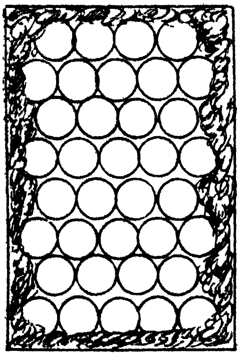
Choice.



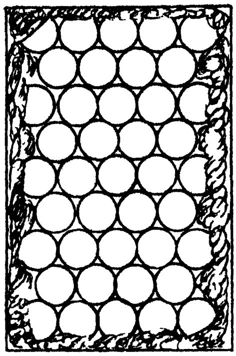
9—6 × 5 = 50.

APRICOTS (*continued*).

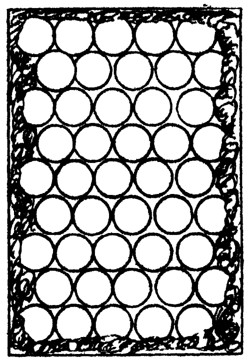
Extra Selected.	Selected.	Choice.
(2) Royal, etc.		



8—5 × 4 = 36.



9—5 × 4 = 41.



9—5 × 5 = 45.

5 × 4; selected, 1¾, 45 fruits, 9 rows 5 × 5; choice, 50 fruits, 9 rows 6 × 5. For other varieties I recommend Royal, Blenheim, Moorpark, and Tilton to be packed as follows, fruit to be table-ripe:—Extra selected 2⅛, 36 fruits, 8 rows 5 × 4; selected, 2, 41 fruits, 9 rows 5 × 4; choice, 1⅞, 45 fruits, 9 rows 5 × 4. No wood-wool to be placed between fruits.

PLUMS.

No wood-wool whatever is to be placed between fruits. On account of its size I do not recommend the *Methley* for export.

Wickson.—This plum should be packed in a firm condition when it is showing yellow to pink at the point. On no account should it be packed after it has become red. Pack it in the following manner:—Extra selected, 2½, 32 fruits, 8 rows 4 × 4; selected, 2⅛, 36 fruits, 8 rows 5 × 4; choice, 2, 41 fruits, 9 rows 5 × 4.

Santa Rosa and *Beauty.*—These two varieties should be packed: (*a*) Santa Rosa when fully coloured, and (*b*) Beauty when it is firm and just amber-coloured. The packing for both should be in the following manner:—Extra selected, 1⅞, 45 fruits, 9 rows 5 × 5; selected, 1¾, 50 fruits, 9 rows 6 × 5; choice, 1⅝, 60 fruits, 10 rows 6 × 6.

Formosa, Gaviota, and Sultan.—These should be packed when they are beginning to show colour, in the following manner:—Extra selected, 2⅜, 28 fruits, 7 rows 4 × 4; selected, 2⅛, 36 fruits 8 rows 5 × 4; choice, 1⅞, 45 fruits, 9 rows 5 × 5.

In "selected" grade, if the fruits are large and just fail to pass as "extra selected," they should be packed 32 fruits, 8 rows 4 × 4. Also in "choice" grade large fruits should be packed 41 fruits, 9 rows 5 × 4.

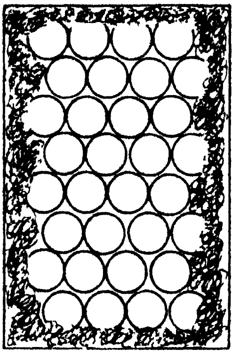
Apple and *Chalcot.*—These should be packed when they are table-ripe in the following manner:—Extra selected, 2¼, 32 fruits, 8 rows 4 × 4; selected, 2, 41 fruits, 9 rows 5 × 4; choice, 1¾, 50 fruits, 9 rows 6 × 5.

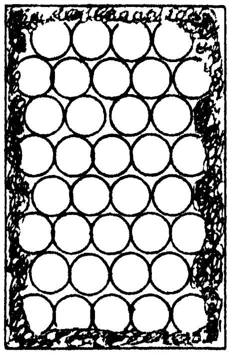
In the "selected" grade large fruits should be packed 36 fruits, 8 rows 5 × 4, and "choice" 45 fruits, 9 rows 5 × 5.

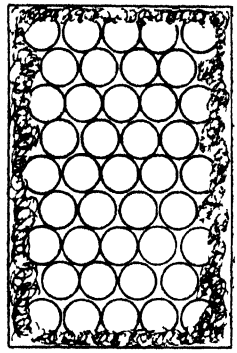
PLUMS.

Extra Selected — Selected. — Choice.

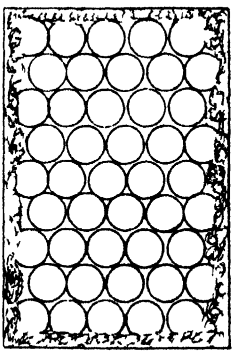
(1) Wickson.

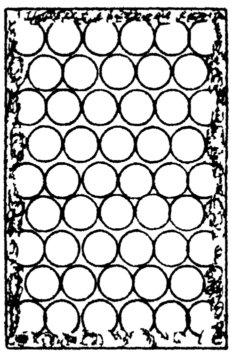

8—4 × 4 = 32.

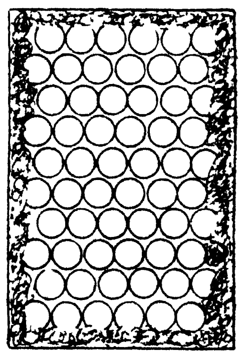

8—5 × 4 = 36.


9—5 × 4 = 41.

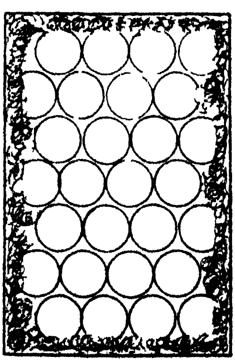
(2) Santa Rosa and Beauty

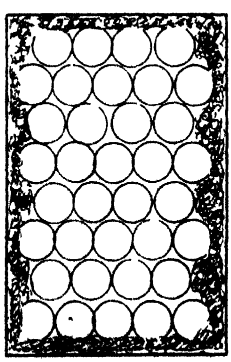

9—5 × 5 = 45

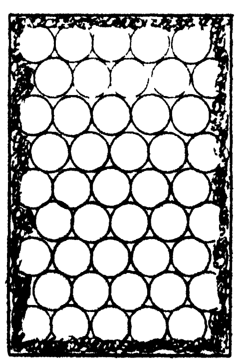

9 - 6 × 5 = 50.


10—6 × 6 = 60.

(3) Formosa etc.


7—4 × 4 = 28.

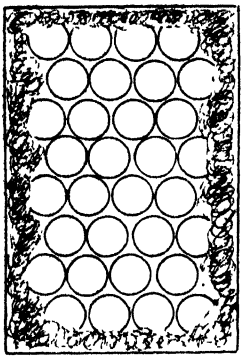

8—5 × 4 = 36.


9—5 × 5 =45.

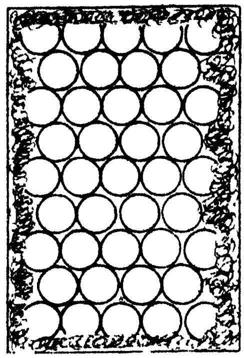
PLUMS (*continued*).

Extra Selected.	Selected.	Choice.

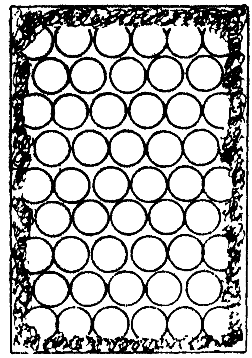
(4) Apple Chalcot.



8 –4 × 4 = 32.

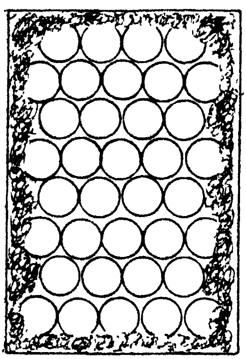


9 –5 × 4 = 41.

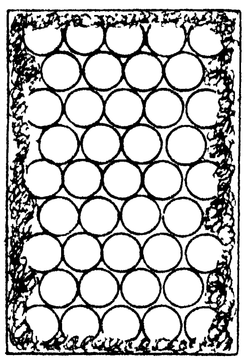


9 –6 × 5 = 50.

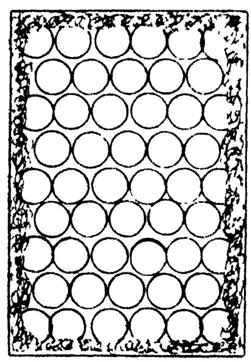
(5) Satsuma.



8—5 × 4 = 36.

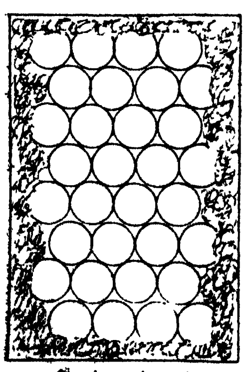


9—5 × 4 = 41.

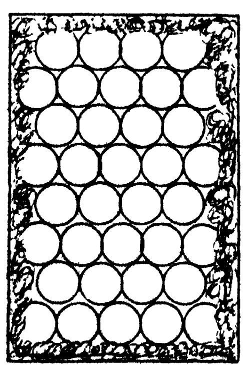


9 -6 × 5 = 50.

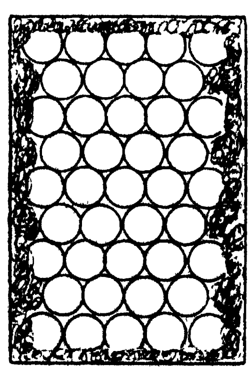
(6) Kelseys.



8—4 × 4 = 32.



8—5 × 4 = 36.



9—5 × 4 = 41.

Satsuma should be packed table-ripe as follows:—Extra selected $2\frac{1}{8}$, 36 fruits, 8 rows 5×4; selected, 2, 41 fruits, 9 rows 5×4; choice, $1\frac{3}{4}$, 50 fruits, 9 rows 6×5.

In "choice" grade larger fruits should be packed 45 fruits, 9 rows 5×5.

Kelseys should be packed when they begin to show colour, as follows:—Extra selected, $2\frac{1}{4}$, 32 fruits, 8 rows 4×4; selected, $2\frac{1}{8}$, 36 fruits, 8 rows 5×4; choice, 2, 41 fruits, 9 rows 5×4.

PEACHES.

Without exception peaches should be packed table-ripe, and wood-wool is to be placed between fruits. The following varieties are recommended:—Crimson Galande, Dr. Hogg, Le Vainqueur, Peregrine, Pucelle de Malines, Waterloo, Inkoos, Early Alexander, Duke of York, Briggs Red May, Royal Georges, and the old Cape Freestone, which is grown under sundry names; and, as a yellow fleshed, the Elberta and no other. The white-fleshed varieties named above should be packed in the following manner:—Extra selected, $2\frac{1}{2}$, 18 fruits, 6 rows 3×3; selected, $2\frac{1}{4}$, 24 fruits, 7 rows 3×4; choice, 2, 28 fruits, 7 rows 4×4.

Some growers pack "selected" 25 fruits, 4×3. This pack is not recommended, as the last fruits placed in the box frequently get bruised. In "selected" grade large fruits should be packed 21 fruits, 6 rows 4×3.

Elberta should be packed:—Extra selected, $2\frac{3}{4}$, 15 fruits, 5 rows 3×3; selected, $2\frac{1}{2}$, 18 fruits, 6 rows 3×3; choice, $2\frac{1}{4}$, 21 fruits, 6 rows 4×3.

NECTARINES.

Without exception, nectarines should be packed table-ripe and the following varieties are recommended:—Early Rivers, Stanwick, Victoria, Albert Dryden, Newton, Goldmine, De Cousa. All varieties should be packed with wood-wool between fruits and, with the exception of Goldmine, as follows:—Extra selected, $2\frac{1}{4}$, 21 fruits, 6 rows 4×3; selected, $2\frac{1}{8}$, 25 fruits, 7 rows 4×3; choice, $1\frac{7}{8}$, 32 fruits, 8 rows 4×4.

In the "choice" grade larger fruits should be packed 28 fruits, 7 rows 4×4.

Goldmine should be packed:—Extra selected, $2\frac{1}{8}$, 25 fruits, 7 rows 4×3; selected, 2, 28 fruits, 7 rows 4×4; choice, $1\frac{7}{8}$, 32 fruits, 8 rows 4×4.

PEARS.

All pears should be packed when fully developed. Bon Chretien pears, however, should never be allowed to get into such an advanced condition that they show signs of ripening. It is better to pack them in a green, hard condition.

The following recommended varieties, viz., Bon Chretien, Beurre Bosc, Beurre Hardy, Clapps Favourite, Beurre Superfine, Rustenburg, and Flemish Beauty, should be packed as follows with no wood-wool between fruits:—Extra selected, $2\frac{3}{4}$, 21 fruits, 6 rows 4×3; selected, $2\frac{1}{2}$, 25 fruits, 7 rows 4×3; choice, $2\frac{1}{4}$, 28 fruits, 7 rows 4×4.

In regard to other varieties the following is recommended:—

Comice and *Glou Morceau*.—Extra selected, 3, 18 fruits, 6 rows 3 × 3; selected, 2¾, 21 fruits, 6 rows 4 × 3; choice, 2½, 25 fruits, 7 rows 4 × 3.

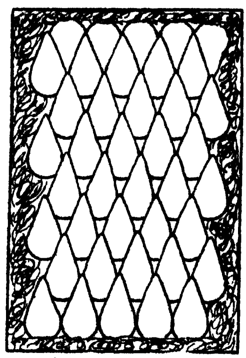
Louise Bonne, Forelle.—Extra selected, 2½, 25 fruits, 7 rows 4 × 3: selected, 2¼, 28 fruits. 7 rows 4 × 4; choice, 2, 36 fruits, 8 rows 5 × 4. In "choice" grade the larger fruits should be packed 32 fruits, 8 rows 4 × 4.

Winter Nelis and *Josephine*.—Extra selected, 2¾, 25 fruits, 7 rows 4 × 3; selected, 2½, 28 fruits, 7 rows 4 × 4; choice, 2¼, 32 fruits, 8 rows 4 × 4.

Keiffer.—Extra selected, 3½, 14 fruits, 7 rows 2 × 2; selected, 3¼. 18 fruits, 6 rows 3 × 3; choice, 2¾, 25 fruits, 7 rows 4 × 3.

In "selected" grade larger fruits should be packed 15 fruits, 6 rows 3 × 2, and "choice" 21 fruits, 6 rows 4 × 3.

In all the hardier varieties of pears, packing of the smaller grades in bulk in standard export apple boxes is strongly recommended and the fruit should be packed in the standard apple packs, no wood-wool whatever being required. This pack is not recommended for Bon Chretiens or Clapps Favourite.



8—5 × 5 = 40.

Method of Packing Pears in Trays.

[NOTE.—In all the packs illustrated in this article, especially the pear pack, an excessive amount of wood-wool is shown between the fruit and the sides of the box. The wood-wool should show as overlapping the fruit, which should itself almost touch the box.]

APPLES.

A special bulletin (No. 1, 1925), has been issued by the Department of Agriculture. It is entitled "The Apple," and is obtainable on application to the Editor of Publications, Department of Agriculture, Pretoria. The price is 1s. 6d. prepaid.

GRAPES.

To lay down a system for the packing of grapes is very difficult indeed; so many different styles of packs have been exported successfully that I do not wish to dogmatize. I strongly recommend, however, the 10-lb. box for some varieties of grapes, such as the

Gros Colman, Gros Maroc, and Henab Turki; the box 6 in. deep should be used; for most other varieties the 5½ in. deep box is satisfactory.

The box should first be lined with wood-wool, not an excessive quantity, but just enough to keep the grapes from coming in contact with the sides or bottom of the box. The bunches should be properly trimmed, all straggly berries should be cut out, and only one bunch should be wrapped in a paper (this at present only refers to "extra selected" and "selected" grades, but I strongly recommend this for all grapes), and in my opinion the bunches should be completely wrapped. When placing the bunches in the box, they should be put in a slanting position to prevent the weight of the bunch coming on to the point or end of the bunch, and enough wood-wool should be placed between the bunches to keep them apart and firm in the box. An excessive amount of wood-wool is most detrimental to the keeping qualities of the grapes; the gross weight of the box should be at least 14¼ lb. to allow for 10 lb. of fruit. Packers should frequently weigh their boxes to be sure of getting the correct net weight.

A GUIDE TO GRAPE PACKERS.

As a guide to packers in grading their grapes, I wish to make the following recommendation as to the size of the bunches, and size, or rather number of berries, to the pound, also the sugar-content of the grapes. The figures given below are for "selected" grade. The packing of a large number of small bunches of three or four berries in one wrapper is deprecated:—

Variety.	Weight of Bunch.	Berries to lb.	Sugar Percentage.
			Per Cent.
Hermitage	8 oz.	100	19
Hanepoot	10 to 12 oz.	80	20
Rosaki and Waltham Cross	10 to 12 oz.	75	18
Barbarossa and Lady Downe	12 to 14 oz.	95	19
Molenera Gorda, Gros Colman, and Henab Turki	14 to 16 oz.	70	19
Raisin Blanc	10 to 12 oz.	80	19

By taking an occasional bunch and testing it by the above system, the packer will be able to arrive at what I consider an ideal size for "selected" grapes. Any grapes larger than the above, provided the berries are of uniform size and free from all blemish, can be packed as "extra selected" grade.

Besides the above varieties, there are at present a large number being tested out by the Department, of which names will be given at a later date.

FIRST-GRADE CREAM, AND CREAM TESTS.*

By E. O. CHALLIS, Superintendent of Dairying, Department of Agriculture.

UNDER dairy legislation the systematic inspection of all creamery books is carried out, and the amount of butter-fat purchased compared with the amount of commercial butter sold, in order to ascertain whether the cream supplier is receiving just and fair treatment.

Nevertheless, it is well to demonstrate why cream tests always do vary, and to give a few practical hints to suppliers on the management of the cream on their farms, with the object of assisting both supplier and creamery, and increasing the percentage of first-grade creams.

THE CREAM SEPARATOR.

The proper handling and care of the cream separator is becoming more generally known; at the same time a large number of cream suppliers have still much to learn in this respect. Some of the salient points affecting the perfect separation of the cream from the milk will be considered, especially in view of the fact that the variations in cream tests depend almost entirely on whether the separator is being worked correctly or not. There are many excellent makes of separators on the market, as well as numerous bad ones. In selecting a machine, choose one that is simple and solidly constructed; is easy to clean and turn; has a minimum of spare parts to be replaced; and, above all, skims clean.

A cheap separator is dear at any price; it wears out quickly; frequently requires new parts, and, after a comparatively short time, will cause no end of trouble between the creamery management and the supplier owing to the variations from day to day in the consistency of the cream. Another great mistake frequently made when purchasing a cream separator is to select one with too small a capacity. Except for those who keep only one or two cows, the use of machines with a capacity of less than 45 gallons per hour is not recommended. The life of small machines is far shorter than that of large ones, owing to the increased time required for separation and the excessive speed at which they have to be driven; neither do they perform such good work, especially if worked for any length of time, as they have to be frequently stopped to enable the bowl to be cleaned out, which, owing to its small capacity, easily becomes clogged.

To ensure good work being performed by any separator, it is essential to have it firmly set up on a solid foundation, care being taken to ensure that the latter is perfectly level. These points are too frequently neglected, with the result that the machine quickly gets

* Originally published as Bulletin No. 82 of 1915.—Ed.

out of order, and clean skimming becomes almost impossible. In selecting a foundation for a machine, it should be borne in mind that the types which have a suspended bowl can be placed directly on a cement floor, a cement block, or solid stone foundation. Machines not having the suspended type of bowl can be similarly fixed, but must have a wooden cushion inserted between the base of the machine and the solid block foundation. This latter precaution is very necessary, as good types of machines frequently go wrong owing to having been bolted down direct on either a stone or concrete base.

THE PRINCIPLE OF SEPARATION.

To give a clear impression of the reasons why cream tests vary, the principal factors which actually cause the cream to separate from the milk will be briefly explained. Generally speaking, the law of gravity as applied by centrifugal force is the principle on which all cream separators work. This law of gravity, when applied to milk in conjunction with centrifugal force, causes the cream to separate from the milk owing to the former being lighter than the latter. Thus, when new milk is admitted to the bowl of a separator which is revolving at a great speed, the skim milk being the heaviest portion of the milk, is immediately flung outwards towards the most distant parts of the circumference of the bowl, i.e. against its outer walls; the cream, being the lighest portion, cannot be thrown so far; consequently it remains nearer the centre of the bowl. To illustrate: take a cork (representing the cream) and a stone (representing the skim milk); a cork cannot be thrown the same distance as a stone, neither can centrifugal force throw the cream the same distance as the skim milk.

Regarding clean skimming and indifferent skimming, many of the troubles which beset and often perplex the user of a cream separator can generally be overcome by using a little patience. Given a first-class machine, indifferent or imperfect skimming can usually be ascribed to one of the following causes, or a combination of several:—(*a*) Too slow a speed in turning the handle; (*b*) irregular turning of handle; (*c*) too cold milk; (*d*) milk not fresh from the cow; (*e*) inflow too fast or too slow; (*f*) bowl out of balance; (*g*) bowl left unwashed from last skimming; (*h*) machine not fixed firmly and not level; (*i*) bad and insufficient lubricating oil. Any good make of separator will skim cleanly if these points are all attended to and the user handles the machine properly. Milk three or four hours old will skim as badly at correct temperature as new milk freshly milked will do when even 15° F. below the correct temperature. Milk straight from the cow requires no reheating when its temperature is below 86° F., but if the milk is older and the temperature has fallen considerably it should be reheated to 90° F. to obtain the best results and prevent loss of butter-fat in the skim milk. In working a cream separator the operator should bear in mind that:—(i) Slow or irregular turning of handle results in bad skimming; (ii) too rapid turning the handle gives the same results as No. (iv); (iii) too fast inflow results in bad skimming; (iv) too slow inflow gives thicker cream and good skimming, but cream is apt to accumulate in the bowl and cause bad skimming later on; (v) too thick cream means a tendency to bad skimming; (vi) too thin cream gives better skimming, but such cream will not keep, or travel well, and gets a lower grade.

CONSISTENCY OF CREAM.

This is usually the cause of trouble experienced between the cream suppliers and the respective creameries, in so far as the variations in cream tests are concerned. Long and varied experience in South Africa has shown that creams which only vary in butter-fat content between 40 per cent. and 50 per cent. give the most satisfactory results. A 45 per cent. cream is to be preferred, but so long as the butter-fat content does not fall below 40 per cent. or exceed 50 per cent. excellent results can be obtained. Actual practice, however, tells quite another story. Test registers at the various creameries show that cream tests vary from 15 per cent. to over 60 per cent., and it is just these variations in the consistency of the cream that cause all the worry with the creamery managers, and so much dissatisfaction among the cream suppliers. Further, one frequently hears that A's test one week was 55 per cent., but B's was over 60 per cent. A moment's reflection will show that they are both producing not only a very heavy bodied cream, which the creamery manager does not require, but are doing so at a considerable loss to themselves. No separator will skim as clean when producing creams containing from 55 per cent. to 60 per cent. butter-fat as it will when the test is below 50 per cent. This is more especially true when inferior machines are used, or machines with a small capacity and which are usually worked too long before being stopped to clean out the bowl. If we consider that, even when separating is conducted on a farm under the most favourable conditions, 0·10 of 1 per cent. is usually left in the skim milk, and that when working under unfavourable conditions, such as producing a very heavy-bodied cream, the loss of butter-fat in the skim milk can easily amount to 0·17 of 1 per cent. the monetary loss incurred, when spread over a year's working, is not only very considerable, but the supplier is producing a class of cream that is not required.

ADJUSTMENT OF THE CREAM SCREW.

Many suppliers who are not familiar with the principles upon which cream separators work, frequently ask how to produce either thick or thin cream; certain important points are therefore mentioned here which should enable any supplier to adjust his machine whether he has directions to guide him or not.

Every separator is provided with an adjustable regulating screw, and the operator should ascertain whether this screw acts on the cream or the skim milk outlets. If it acts on the cream outlet and if thicker cream is required, the regulating screw is turned inwards, and if thinner, the reverse. The reason is that thick or heavy-bodied cream is lighter than thin cream and it consequently remains nearest the centre of the bowl, also that less skim milk escapes with the cream when the regulating screw is turned inwards; conversely, more skim milk escapes with the cream should the screw be turned the reverse way. On the other hand, should the regulating screw act on the skim milk outlet in the bowl, which is the case with many machines, the operator must adjust the screw in the opposite direction to that required when acting on the cream outlet. This may appear to be somewhat of an anomaly, but when a regulating screw which acts on the skim milk outlet is turned inwards, it produces a thinner cream, as by such inward turning the size of the skim milk outlet is reduced;

FIG. 1.—Percentages of butter-fat contained in the milk used during various trials.

more skim milk is thus forced out with the cream and a thinner cream results. By the same rule when the screw acting on the skim milk is turned outwards, the opposite effect is produced. Whether the regulating screw is acting on the cream or skim milk outlets, half a turn one way or the other makes a tremendous difference in the consistency of the resulting cream. The greater the knowledge our cream

suppliers possess of the successful working of their machines the less likely are they to complain in regard to the variations in their cream tests.

WHY DO CREAM TESTS VARY?

In order to arrive at accurate and definite conclusions as to why cream tests vary from day to day, a very large amount of detailed work was undertaken a few years ago. By kind permission, the Transvaal Dairy, Pretoria, was at that time placed at the disposal of this work, and numerous speed trials were conducted there. Several experiments were also undertaken at the Schools of Agriculture at Potchefstroom and Cedara by officers of the Dairy Division. A new 45-gallon separator of approved type was used in all the experiments, and only those results which were definite and proved accurate by check tests are given.

A most important point, and the one most frequently neglected, is "speed." The importance of runing a cream separator at the correct speed cannot be over-estimated, as it has such a far-reaching effect on the consistency of the resulting cream. By maintaining a uniform and correct speed, less variations in the cream will occur.

SPEED TRIALS—TABLE NO. 1.

Number.	Weight of Milk used.	Per Cent. of Butter-Fat in Milk	Temperature of Milk.	Number of Turns of Separator Handle per Minute.	Per Cent. of Butter-Fat in Cream
1	41 lb	4·0	86 F.	60	54
2	41 „	4·30	86 „	55	46
3	41 „	4·30	86 „	50	31
4	41 „	4·30	86° „	45	26
5	41 „	1·30	86 „	Irregular turning	44

The results obtained by running a separator at various speeds are given in Speed Trial Table No. 1. It will be noticed from the figures that turning the handle at the correct speed, viz., 60 revolutions per minute, gave a cream containing 54 per cent. of butter-fat; when the speed was reduced to 45 turns, using the same machine and the same milk, the percentage of butter-fat in the resulting cream was immediately reduced to 26 per cent.; irregular turning, such as too fast and too slow, produced a cream containing 44 per cent. of butter-fat. It will thus be seen how very easily cream tests can fluctuate from day to day simply through varying the speed of the separator.

That cream suppliers do not realize sufficiently the important bearing speed has in connexion with cream separating, is borne out by the fact that they frequently give the assurance that their separators are always turned at the correct speed, whereas it is known from experience that this cannot be the case, especially with the class of labour usually employed in this country. The best method to employ, especially with natives, is to use a simple little instrument called a metronome, shown in Figue 2. This can easily be adjusted to suit the speed of any machine, and the pendulum, which merely swings backwards and forwards, acts as an indicator to the native working the separator; in fact only when the metronome is correctly set and the handle of the machine is turned exactly in time with the swinging

of the pendulum, can it be safely said that the speed of the separator has been correctly maintained. It is always advisable to work a separator at the speed recommended by the makers preferably 3 to 5 per cent. higher than lower. The only time when it is permissible to reduce the speed of any machine is when the feed bowl is partly empty. This, however, can be easily regulated by watching the jet of cream as it leaves the cream spout. If it turns in under the spout, the speed of the machine is too great for the amount of milk which is passing through the bowl; on the other hand, it the cream shoots out

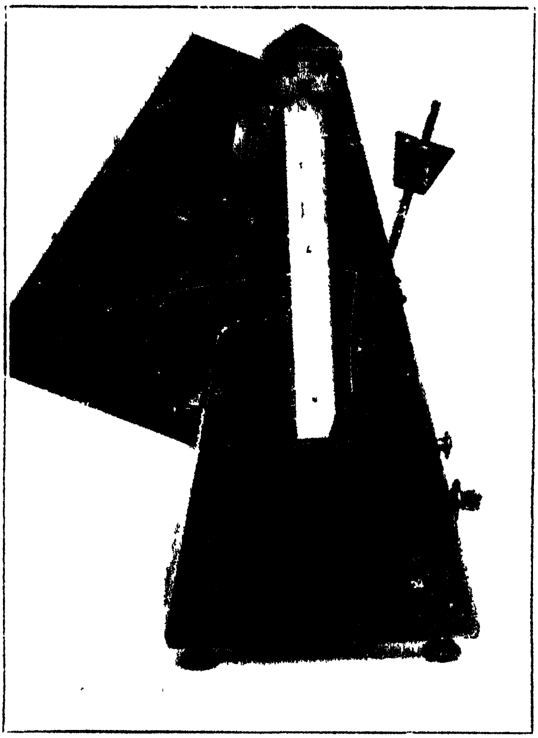


FIG. 2.- Metronome used for checking and regulating the proper speed for turning the separator crank.

from the spout with a slight twirl, the separator is either not properly adjusted or the operator is turning too slowly. When the cream falls nearly but not quite straight from the spout into the cream bucket, it is usually, with most makes of machines, of about the right consistency.

As these speed trials conclusively demonstrated how easily suppliers' cream tests can vary from day to day, there is yet another aspect which must not be lost sight of, and that is, that although cream tests do vary it does not always follow that a supplier is receiving a smaller return for a low test than he is for a higher one. For example, if two suppliers were given 50 gallons of milk each, containing 4 per cent. butter-fat, and each worked his machine at the correct speed and under equally favourable conditions, one supplier

might produce a 45 per cent. cream, and the other a 34 per cent. cream, and yet both receive the same monetary value for the butter-fat content in the cream so produced, as the *volume* of the 34 per cent. cream would be greater than the 45 per cent. cream. Assuming that the conditions of separating in each instance were identical, and the percentage of butter-fat in the skim milk approximately the same, then it simply means that one supplier's separator is regulated to produce a 45 per cent. cream and that of the other a 34 per cent. cream. The only advantage gained, from a financial point of view, by the supplier of the 45 per cent. cream would be through the extra amount of skim milk he would have available with which to feed his calves and pigs.

SPEED TRIALS—TABLE No. 2.

Bottle Labelled.	Trial Number.	Weight of Milk used.	Temperature of Milk.	Test of Milk.	Total Fat in Milk.	Number of Turns of Separator Crank.	Weight of Cream obtained.	Test of Cream.	Total Fat in Cream.	Weight of Skimmed Milk.	Test of Skimmed Milk.	Total Fat in Skimmed Milk.	Total Fat in Cream and Skimmed Milk.	Loss of whole Milk during Trial and Separation.	Loss of Fat adhering to Utensils, etc., Irrecoverable.
		lb.	°F.	%	lb.		lb.	%	lb.	lb.	%	lb.	lb.	lb.	lb.
A.	1	41	90	3·5	1·435	74	2·7	52	1·404	38·2	·03	0·011	1·415	0·1	0·020
B.	2	41	88	3·5	1·435	*60	4·2	34	1·428	36·7	·015	0·005	1·433	0·1	0·002
C.	4	41	86	3·5	1·435	Irregular	5·2	27	1·404	35·6	·05	0·017	1·421	0·2	0·014
D.	3	41	88	3·5	1·435	40	7·0	20	1·400	33·9	·05	0·017	1·417	0·1	0·018

* Correct speed.

Table 2 gives the figures of a second speed trial conducted in Pretoria. It will be observed that when the machine was run at the correct speed of 60 revolutions per minute, it produced cream containing 34 per cent. of butter-fat; when the speed was increased from 60 to 74 revolutions the butter-fat in the resulting cream was increased to 52 per cent.; thus too high a speed will increase the butter-fat content of cream very considerably, and too slow a speed will reduce it. Also here the best result was obtained when running the machine at the correct speed; further, when a machine is being worked every day under ordinary farm conditions, nothing like the low percentages of butter-fat would be found in the skim milk as are depicted in this table. As previously stated, if in ordinary circumstances a separator leaves only ·10 of 1 per cent. in the skim milk, it is performing very good work.

Fig. 3 illustrates the various percentages of butter-fat obtained in the second speed trial, and shows how easily the butter-fat content of cream can vary materially even from the same milk, if the correct speed is not maintained. In making this test, 9 grammes of cream by weight were taken, so the percentage of butter-fat as depicted in the necks of the bottles is in each instance doubled.

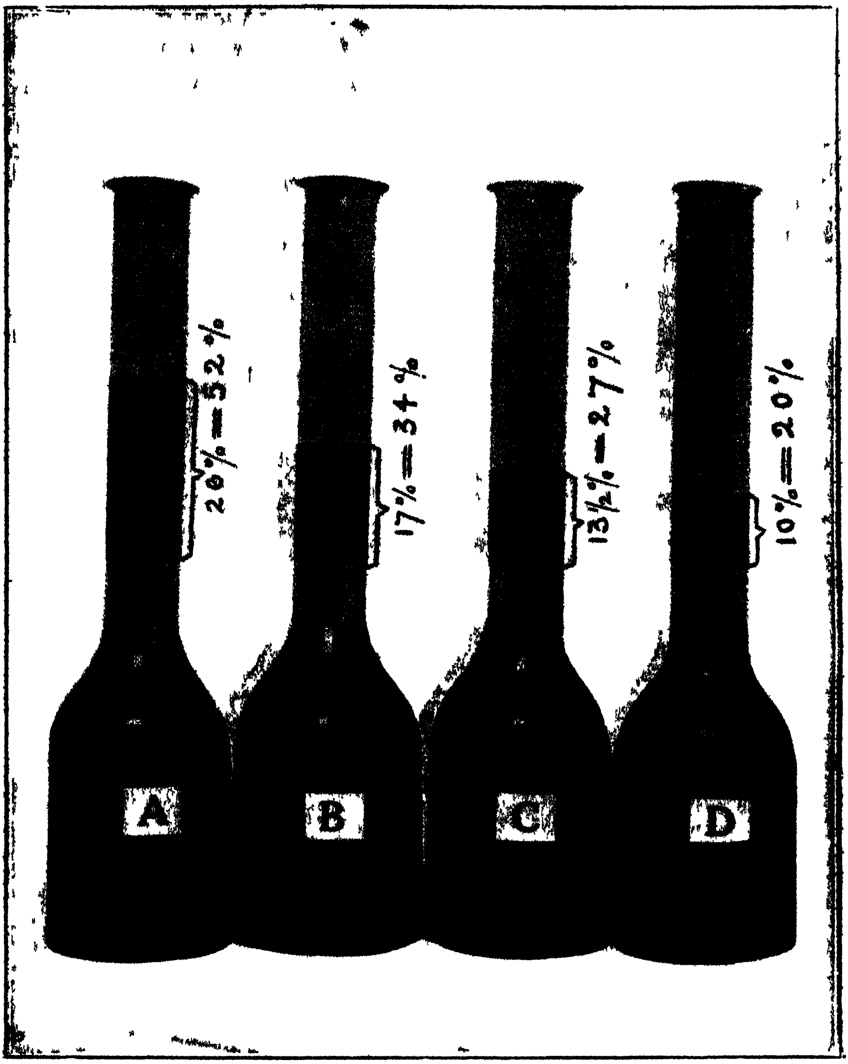


FIG 3.—Butter-fat contents of cream obtained from the same milk, but with the separator run at various speeds. (See Table No 2)

Sample A, turning too fast, producing 52 per cent. butter-fat in cream
Sample B, correct turning, producing 34 per cent. butter-fat in cream.
Sample C, irregular turning, producing 27 per cent. butter-fat in cream.
Sample D, turning at low speed, producing 20 per cent butter-fat in cream

The third set of experiments was made for the purpose of separating, under identical conditions, naturally rich and naturally poor milks, whereby another reason why cream tests vary was arrived at, even though the separator was run at the correct speed. Table 3 gives the figures obtained in this trial, and Figure 4 the percentages of butter-fat contained in the cream from the respective samples of

milk. It will be noticed that the percentage of butter-fat contained in the cream when using a 4·8 per cent. milk was 49 per cent., whereas when a 2·9 per cent. milk was put through the machine under exactly similar conditions a cream containing only 38 per cent. butter-fat was obtained. This proves very effectively that even when running a machine at correct speed there still may be variations in the cream tests owing to the fluctuations from time to time which will occur in the butter-fat content of milk used for the production of cream. This is particularly true in South Africa, where the practice of hand-rearing calves is so conspicuous by its absence. The percentage of

RESULTS OF SEPARATING RICH AND POOR MILK—TABLE NO. 3.

Bottle Labelled.	Trial Number.	Weight of Milk used.	Temperature of Milk.	Test of Milk.	Total Fat in Milk.	Number of Turns of Separator Crank.	Weight of Cream obtained.	Test of Cream.	Total Fat in Cream.	Weight of Skimmed Milk.	Test of Skimmed Milk.	Total Fat in Skimmed Milk.	Total Fat in Cream and Skimmed Milk.	Loss of whole Milk during Trial and Separation.	Loss of Fat adhering to Utensils, etc., Irrecoverable.
		lb.	°F.	%	lb.		lb.	%	lb.	lb.	%	lb.	lb.	lb.	lb.
E	5	41	88	4·3	1·968	60	4·0	49	1·960	36·9	·015	0·005	1·965	0·1	0·003
F.	6	41	88	2·9	1·184	60	3·1	38	1·178	37·8	·02	0·007	1·185	0·1	0·004

butter-fat which milk contains in ordinary circumstances depends in a great measure on the manner in which the milking operations are conducted. Native milkers on some days milk the cows out fairly clean, and if a greater proportion of the richest milk, more generally known as the strippings, be obtained, the milk on that particular day will be considerably richer. Similarly, if the milking is carried out indifferently, and the calf does the stripping instead of the milker, the milk on that particular day will be so much the poorer in butter-fat, and the cream test correspondingly lower.

SEPARATING AT VARIOUS TEMPERATURES—TABLE NO. 4.

Weight of Milk used.	Test of Milk.	Fat in Milk.	Temperature of Milk.	Turns of Separator Crank.	Weight of Cream.	Test of Cream obtained.	Fat in Cream.	Fat not Recovered.
lb.	%	lb.	F.		lb.	%	lb.	lb.
40	3·7	1·48	90	60	3·40	42	1·42	·06
40	3·7	1·48	80	60	2·75	51	1·40	·08
40	3·7	1·48	74	60	2·66	52	1·38	·10

The fourth and final experiment was carried out merely to ascertain what effect separating milk at various temperatures would have on the butter-fat content of the resulting cream. Table 4 proves conclusively that another definite reason is found for variations in

Fig. 4.—Results obtained by separating naturally rich and naturally poor milk under identically the same conditions. (See Table No. 3.)

Sample E, at 60 turns per minute gave a cream of 49 per cent. butter-fat from a 4·8 per cent milk.

Sample F shows a 38 per cent. butter-fat cream from a 2·9 per cent. milk.

cream tests. When the milk was separated at the correct temperature of 90° F., a cream containing 42 per cent. of butter-fat was obtained; but immediately the temperature of the milk was allowed to fall to 80° F. a 51 per cent. cream was produced. This would account for cream tests, especially during the winter months, being suddenly much higher on some days than others, even though the speed of the machine had been correct and the regulating screw unchanged.

If a machine could do equally good work at low temperatures, separating at low rather than high temperatures should be preferred during the summer months, as the resulting cream would keep better and arrive at the creamery in a sounder condition. Unfortunately, it is known from experience that separating milk which has been partly cooled can only be accomplished at the expense of clean skimming, owing to the more viscous condition of the milk. This is more especially true when the skimming operations occupy a considerable period of time.

SUMMARY OF REASONS WHY CREAM TESTS VARY.

The following is a concise summary of the principal reasons why cream tests vary from time to time:—

(1) Speed of separator being either too low or too high.
(2) Separator running badly through using inferior oil, or bowl vibrating through being out of balance.
(3) Removing the milk float and feeding the machine beyond its capacity.
(4) Neglecting to alter the cream-regulating screw in spring time when milk is poor and in autumn when milk is richer.
(5) Fluctuations in the temperature of the milk.
(6) Changes in the richness of milk, either from morning or evening milkings, and more especially through indifferent milking.
(7) Amount of skim milk or water used for flushing the bowl, which often varies from day to day.
(8) Using a cheap or inferior type of separator.

TREATMENT OF CREAM ON THE FARM.

The success of a creamery depends largely on the class of cream it receives, and this, as has been shown, varies greatly; and were it not for the strict grading which any creamery worthy of the name must insist upon, a greater proportion of South African butters would indeed be of very inferior quality. If allowance is made for certain periods of the year when food taints are distinctly discernible in the cream, which, although difficult to avoid, could, if greater care were exercised, be minimized very much, we come to the root of an evil affecting the production of first-grade cream, viz., the lack of strict attention to cleanliness. Frequent examinations of cream supplies from the same district, and even from adjoining farms, have resulted in some suppliers getting first grade, others second, and some even third. Each supplier was working under the same climatic conditions, and the cream had to travel approximately the same distance, so that there must have been something very radically wrong in the methods employed in caring for the cream by those suppliers who were only getting second and third grade returns.

CLEAN MILKING.

To produce a sound, clean-flavoured cream, with good keeping qualities, the greatest attention to cleanliness in the milking operations must be insisted upon, and such should be carried out in a pure atmosphere free from dust. Where cows are milked in stables, a native should be told off, about twenty minutes before milking starts, to thoroughly brush the udders and flanks of the cows, followed by washing the udders and drying them with a clean cloth. From experience it is known that this procedure is seldom carried out; nevertheless it is highly essential in order to ensure the production of first-grade cream. The usual excuse that labour is scarce and that it takes too long to attend to details of this description will not hold good; where cows are kept under anything like hygienic conditions, it does not take so much time to prepare their udders for cleanly milking as many people imagine.

WET *versus* DRY MILKING.

Undoubtedly dry milking is the cleanest and best method to adopt, but the native milker who can milk with dry hands is still to be found. To begin with, he usually milks a little milk into each hand and afterwards when his hands again feel dry he dips them into the milk bucket itself. Notwithstanding it being a most objectionable practice, it is nevertheless one of daily occurrence, as is only too well known from personal experience. Nearly all owners of dairy stock are quite aware that it is almost impossible to get native milkers to milk in the correct way, and it is equally impossible to get them to milk with dry hands. As a consequence, many years ago numerous experiments were carried out, and instead of wetting the teats a small quantity of vaseline was applied to each teat. This method was found to work admirably with native milkers, for, besides reducing the friction on the cows' teats, which is pretty severe, owing to the finger and thumb process of milking employed by the natives, it also removes one of the chief causes of cracked teats, viz., turning cows out with wet teats when a cold wind is blowing. After milking, the milk should be immediately removed to the separating-room, or a pure atmosphere, as warm milk, especially in a falling temperature, will readily absorb various odours.

THE SEPARATOR-ROOM.

The separator-room need not be elaborate if it is not utilized also for keeping the cream in, but must at the same time be provided with a concrete floor, be well ventilated, possess good drainage facilities and a liberal supply of hot and cold water, and be kept scrupulously clean and free from flies. Many farmers have, for convenience sake, the separator-room attached to the cow-byre. Preferably it should be placed elsewhere, but if the aforementioned conditions relating to the separator-room are strictly enforced, and there is no direct communication between the byre and the milkroom, such an arrangement is permissible. The conditions necessary for the separator-room also apply to the room where the cream is kept prior to being dispatched to the creamery, with the exception that the latter must be so constructed that the inside temperature is as cool as possible and the atmosphere surrounding the cream beyond reproach. Nothing likely

to taint the cream must ever be placed in the room where the cream is kept. This is not always observed, and sometimes meat, vegetables, fruit, and even harness are stored in it; as a consequence the cream so kept is frequently second graded owing to its flavour having been destroyed by absorbing the odours from an impure atmosphere.

THE COOLING AND TREATMENT OF THE CREAM.

Immediately after separating operations are over, the cream should be cooled at once to as low a temperature as possible. This is of the utmost importance, and can be carried out in various ways. When a good supply of cold water is available, the best method to adopt is to run the cream direct from the cream spout, over a small circular or vertical cooler, through which the cold water is continuously flowing. This process, when properly carried out, quickly reduces the temperature of the cream to within a few degrees of the water used, and at the same time thoroughly aerates it; this in itself is beneficial, provided the atmosphere where the cooling and aeration takes place is sweet and pure.

Another device for cooling cream is to place the vessels containing the cream in a wooden or metal trough through which cold water flows from an intake near the bottom to an outflow near the top. This requires an ample water supply, but where the outflow can be utilized for other purposes it is certainly the next best cooling device to a cream cooler, provided also that the cream whilst cooling is frequently stirred. The importance of reducing the temperature of cream as quickly as possible during the hot summer months cannot be over-estimated, and although this is difficult without artificial means, the reduction of the temperature by even a few degrees is most beneficial. Concerning the treatment of the cream during the ripening process, the first essential to remember is, "*never mix warm cream with that already cooled.*" This is an extremely common fault among cream suppliers, and one which is the primary cause of that most objecionable of all flavours known as the "fermented flavour." Different batches of cream should never be mixed unless they are at the same temperature, and when mixing creams of varying ripeness together care should be exercised to thoroughly stir them, to ensure thorough mixing and uniform ripening.

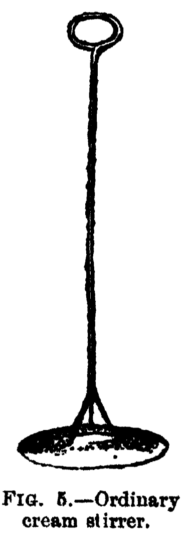


FIG. 5.—Ordinary cream stirrer.

All cream, whether being mixed or not, should be frequently stirred, as this prevents the surface from becoming oxidized and a hard crust being formed thereon; it also prevents the cream from becoming lumpy, and encourages the production of a nice, clean-flavoured acidity. A small metal stirrer (see Fig. 5) will answer the purpose. If no metal stirrer is available, a stirrer made of hard, impervious, and non-odorous wood can be used.

CREAM VATS.

Suitable vessels for keeping cream in until dispatched to the creamery are essential and may be classified as follows:—Unchipped

enamel buckets, well-tinned seamless buckets, and earthenware jars. Enamel buckets are by far the best, the only objection being that, if the enamel in the interior of the buckets becomes chipped, they are rendered useless as cream receptacles. The risk of chipping is, however, greatly minimized if the buckets are only used for keeping cream in, and are not allowed to be used for any other purpose. Glazed earthenware jars are only recommended for cream which has previously been thoroughly cooled, as great difficulty will be experienced in cooling down warm cream in such vessels.

A cylindrical shaped cream ripening vat (see Fig. 6) made either of enamel or well-tinned seamless metal can be used with advantage, and will obviate the necessity of having to buy so many

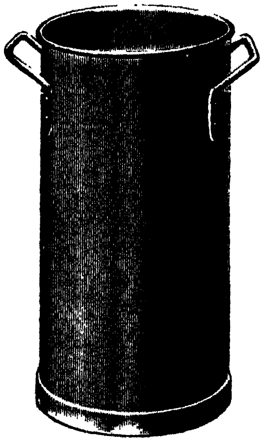
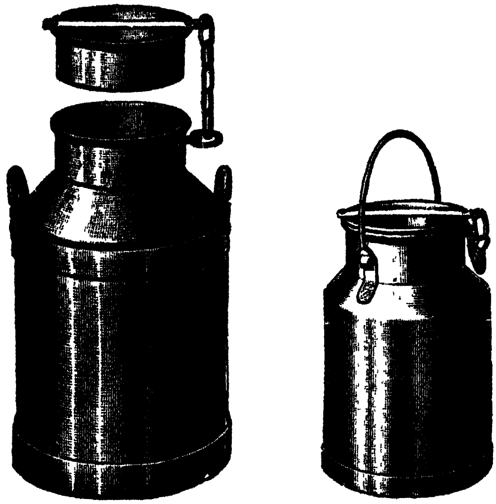


FIG. 6.—Cream ripening vat or receptacle.



FIGS. 7 and 8.—Small and large size bottle-shaped cream cans made of stout seamless tinned steel.

enamel buckets, as the cream, when properly cooled down, can be emptied into the ripening vat, and if kept well stirred will ensure its uniform ripening. The practice of keeping cream in the same cans which travel backwards and forwards to the various creameries is not to be recommended. Owing to the rough treatment they receive, their inner tinned surfaces get worn off quickly, and if over-ripe cream is kept in such cans for any length of time it will develop a distinctly metallic flavour owing to the action of the lactic acid on the untinned portions of the cans; this metallic flavour will be imparted to the resulting butter.

CREAM CANS.

Many years of experimenting with various types of cream cans have shown that what is known as the bottle-shaped seamless can is the most suitable (see Figures 7 and 8). Taking into consideration our climatic conditions and the long distances which cream supplies have to travel, often over extremely rough roads, the consensus of opinion among creamery managers is that, in practically every instance, cream arrives in better condition in the bottle-shaped type of can than it does in other types such as the straight-sided "gun shot" can with wide mouth.

The adoption in time of a uniform type of can throughout the Union is desirable, and nothing but seamless cans should be allowed to be used, as the making of this class of can has now reached a very high standard of excellence. Many of the cream cans still in use are totally unfit receptacles for cream, and the time is not far distant when their use will be entirely prohibited.

HOW LONG SHOULD CREAM BE KEPT.

Cream kept under normal conditions for thirty-six to forty hours at a temperature of 60° F. will usually develop sufficient acidity for churning purposes in that time; consequently, the major portion of cream supplies arrive at their respective destinations in an over-ripe condition, especially during the summer months. Cream suppliers should therefore dispatch their cream as frequently as possible, certainly not less than three times a week in the summer and not less than twice a week during the winter.

Many cream suppliers would greatly prefer to send their cream away only once a week all the year round, and some not as often as that, but it is impossible to turn out anything but a low-grade butter from cream supplies of this description.

CARE OF CREAM IN TRANSIT.

This is very important, and present methods can be considerably improved, although there are many difficulties which have to be faced. Nevertheless, suppliers who send their cream direct to a railway station, or to meet the nearest cream collecting cart, should at least protect the cream cans from the direct rays of the sun by the use of wet sacks or blankets. This precaution is of great assistance in the dairy industry and often prevents first-grade creams being second graded. The supplier having exercised all the care possible, railway officials and the drivers of the cream-collecting carts should on their part ensure such cream reaching its final destination in as satisfactory condition as possible.

WASHING DAIRY UTENSILS.

To many it may seem unnecessary to deal with this matter, but it is one of the keynotes to successful dairying. It is simply amazing how many people wash dairy utensils the wrong way, as the corroded state in which one so often finds tinned vessels clearly indicates. In the cleaning process of dairy utensils, the first essential is to wash them immediately after use, and not to leave them for several hours for the milk and cream to dry on the surface of the tinware, which means that in the subsequent washing extra time, labour, and expense are involved. Another point to observe is never to use boiling water on any dairy utensils until they have first been thoroughly cleansed with lukewarm water. Finally, always use a brush and not a cloth for cleansing the utensils. If a cloth should be required for drying purposes, then a clean piece of butter-muslin wrung out in boiling water is the best to use, although most tin utensils, if the final washing is done in boiling water, will dry of themselves when put out to air. Soap should never be used for cleansing any dairy utensils, but the occasional use of a reputable cleansing powder is recommended, and can be used with safety. Immediately the cream cans arrive

back from the creamery their lids should be removed at once and the cans be placed in an inverted position on a rack for a thorough airing.

Although the creameries wash and steam all cream cans before returning them, this does not imply that they do not require thorough scalding before being used again, and suppliers are advised to adopt this precaution at all times. If these details with regard to cleansing utensils are adopted and properly carried out they will go a long way towards increasing the percentage of first-grade cream.

SUMMARY.

"*Never*" mix warm cream with that already cooled until both are at the same temperature.

When mixing different creams together, stir them well as this ensures uniform ripening.

Neglect to stir cream encourages the development of unfavourable bacteria, produces "cheesy" butter, and reduces the amount of the supplier's monthly cheque.

Keep the creamroom well aired and scrupulously clean; do not store in it fruit, vegetables, meat, harness, etc., as their presence will result in a second or third grade cream.

Do not aim at producing a heavy bodied cream containing 60 per cent. or more of butter-fat under the impression that it is better value than a 45 per cent. cream; it is not. On the contrary, money will be lost as well as the creamery manager's temper.

Protect the cream while in transit from the direct rays of the sun, otherwise a second-grade cream will be the result.

Never ripen cream in a closed vessel, but cover it only with a clean piece of muslin to keep out flies and dust, and permit the free circulation of air.

Keep the separator clean, as well as the separator parts, and protect the machine with a cloth when not in use.

Use only the best separator oil; inferior oils are dear at any price, as will be found by experience.

Do not put the separator parts together in the morning ready for use in the evening, but keep them well aired, and assemble them just before separating time.

Do not fail to remove the lids of the cream cans immediately you receive them from the creamery; scald the cans well before using again.

Never use soap on any dairy utensils, nor, if possible, a cloth to wash them with. A scrubbing brush is much cleaner and far more effective.

In case of a grievance against a creamery, or any trouble with the cream, see the manager about the matter.

Cleanliness in dairying means success in dairying; neglect of this essential means endless trouble.

DEPARTMENTAL PUBLICATIONS.

THE MONTHLY.

"Farming in South Africa" is published monthly in English and Afrikaans by the Department of Agriculture.

The subscription is 5s. per annum, post free, for residents within the Union and South-West Africa (otherwise 6s.) and payable in advance to the Government Printer, Koch Street, Pretoria. Specimen copies can be seen at any Post Office, Police Station, or Magistrate's Office, where subscriptions can also be paid.

The publication is chiefly comprised of information in the form of notes and short articles, emanating from the Department of Agriculture, of practical value to farmers in South Africa, and includes also the weekly advice leaflets issued by the Department.

THE QUARTERLY.

In addition to the above, there is published quarterly, in English and Afrikaans, the **"Journal of the Department of Agriculture,"** which contains articles, reports, etc., dealing with the work of the Department (including its Annual Report). This journal is the chief medium of recording the results of the Department's experiments and investigations It is obtainable from the Government Printer at the same subscription rate as *Farming in South Africa* (5s. per annum; 1s. 6d. per copy).

CROP AND MARKET NEWS.

Crops and Markets is a monthly publication in English and Afrikaans. It contains reports on the condition of the crops in season, statements of monthly exports, local and overseas market prices, and general information on South African produce, etc. It is obtainable, free of charge, on application to the Chief, Division of Agricultural Economics, Marketing, and Co-operation (Crop Section), Union Buildings, Pretoria.

AGRICULTURAL BULLETIN SERVICE.

A selected number of Agricultural Bulletins (the majority being reprints from the above publications) are provided at a small cost. A list of such bulletins (together with particulars of cost, etc.) will be furnished free of charge on application to the Department of Agriculture (Publications), Union Buildings, Pretoria.

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